User Manual

go2MONITOR 1.2

by PLATH AG, Switzerland

Imprint

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Contents

General

Welcome to go2MONITOR

go2MONITOR is a modular software solution for receiver control, classification, demodulation, decoding and recording of LF, HF, VHF, UHF signals. Current wideband software defined radios (SDR) demand for a new generation of monitoring tools as complex monitoring systems should not be limited by the number of decoders. go2MONITOR is the perfect, none-intrusive signal monitoring solution for:

Homeland and government, security agencies

New threats demand superiority of information. Acquisition of information means gathering and analyzing information of all potential sources. In addition the increasing density of signals, the growing complexity and the use of new or modified modems are posing a challenge in which go2MONITOR assists the operator in his daily work by providing all the required tools and an easy to use user interface. The software provides the functions to record the spectrum for later analyzing and processing by more specialized tools and experts.

Telecommunications authorities

Identification and monitoring of new or existing signals is a main task of telecommunication authorities. Due to modern telecommunication systems this is no longer an easy work in standard manual operation. The automatic approach of go2MONITOR saves a lot of time and costs.

COMINT, signal corps

go2MONITOR is a standalone application and is perfectly suited for rapid reaction task forces and advanced commands. All that is required for monitoring are go2MONITOR, a laptop, a SDR and an antenna!

System integrators

A TCP/IP remote control interface is available for external applications and provides all the function required to integrate go2MONITOR into your application. Applications will be earlier on the market and do not bear the risk and costs of the development of an own software.

go2MONITOR displays an overview of the signal scenario utilizing a spectrogram and a spectrum FFT. Various display settings, cursors, and a dynamic zoom are available.

Features

- 1 MHz wideband input (spectrogram, Fast Fourier Transform (FFT), classifier)
- Automated classification and production using an extensive decoder library
- State-of-the-art GUI includes window pre-sets, drag & drop, and integrated station list
- Integrated receiver control with direct Software Defined Radio (SDR) interface
- Parallel processing of up to eight buffered Digital Down Conversion (DDC) production channels

- Decoder Description Language (DDL) support. Extend your decoder list without releasing any information

Benefits

- Few lost or unidentified signals with a high number of produced signals
- Fast reaction to modified modems
- Keep the knowledge in your organization
- High order of automation

go2SIGNALS

The use of radio communication is constantly rising. The traditional approach of monitoring this more and more connected signal scenario with a manual approach of channel stepping and manual search is not promising for future challenges.

The product line go2SIGNALS covers customer requirements from traditional manual signal handling to fully automatic intelligence system. This provides processing speed and user comfort of automatic intelligence systems to single user working positions. It is the perfect solution for mobile, stand-alone and remote controlled applications as well as a start into the world of automatic monitoring.

The focus of go2SIGNALS is on radio monitoring. Future products will also contain some parts of Communications Intelligence (COMINT) or Signal Intelligence (SIGINT).

go2MONITOR is a modular software solution for receiver control, classification, demodulation, decoding and recording of HF, VHF, UHF signal.

go2DECODE is a standalone software for signal recognition, demodulation, decoding, speech detection, signal recording and technical signal analysis.

go2ANALYSE is a bit stream analysis software for manual determination of code characteristics.

go2RECORD is a powerful integrated solution for monitoring, recording and extraction of wideband signal scenarios in a user-friendly and interactive way.

About us

PLATH AG (formerly PLATH Procitec Suisse AG - PPS AG) was founded in 2006. The main intention was building up software development expertise and getting closer to the Swiss market. By now PLATH AG also provides systems and services to international markets.

The portfolio of the PLATH AG focuses on the challenges in the business of information and communication technologies. As system developers and integrators and in cooperation with our industrial partners, we jointly supply complete system solutions in the sector of IT and communications engineering. We see the biggest challenges in customer specific software and system development as well as in a structured and efficient project management for customers with high demands of quality. Additionally PLATH AG supplies further services in the field of system installation, maintenance and consulting.

Revisions

Release	Date	Editor	History
1.2	2013-04-01	Rha/MBu	First release Added content: - maw files - Licensing - bin, txt, ver - cmf - wavetxt
	2013-04-24	MBu	Chapter “Start the Application” renamed to “Signal Sources “ and reorganized
	2013-05-25	RHa	Added content: - Specifications - Install Premium Decoder

Setup

Installation

This chapter describes the installation on a computer with Windows 7 operating system. For the installation of the application go2MONITOR you need the installation data carrier (DVD, USB-Memory, ZIP file, etc.) with the required files from PLATH AG.

During the installation the application and the WiBuKey driver are installed. If the installation of the dongle is not started automatically, locate the WiBuKey_Runtime folder on the installation data carrier and install the WiBuKey driver manually.

Insert the installation DVD into drive of your computer and start the Setup.exe.

Important: Old Versions must not be uninstalled as new versions will be installed in a new directory.

Follow the installation wizard as described in the following figures:

Figure 1: Welcome Screen of the Installation Assistant

Read the text in the dialog and press <**Next**>.

Figure 2: License Agreement

Please read the license agreement and select **I accept the terms in the License Agreement** and click on <**Next**>.

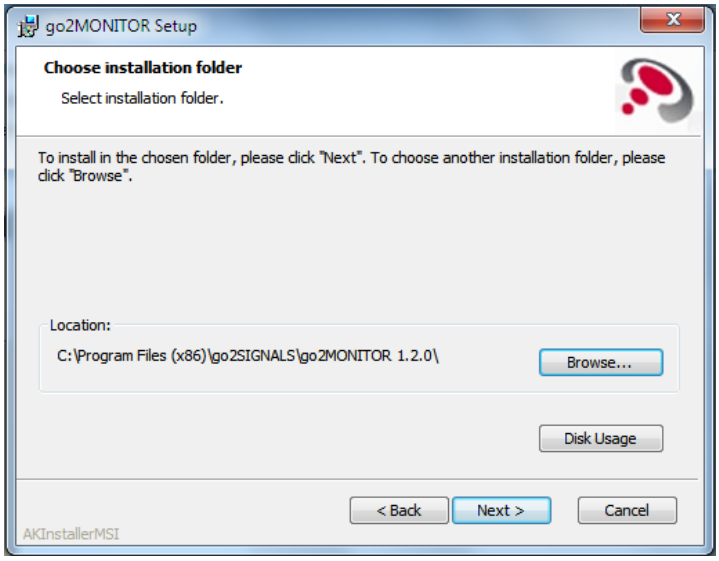


Figure 3: File Location

Check whether the installation location is correct. If necessary, browse for a different location and click on <**Next**>.

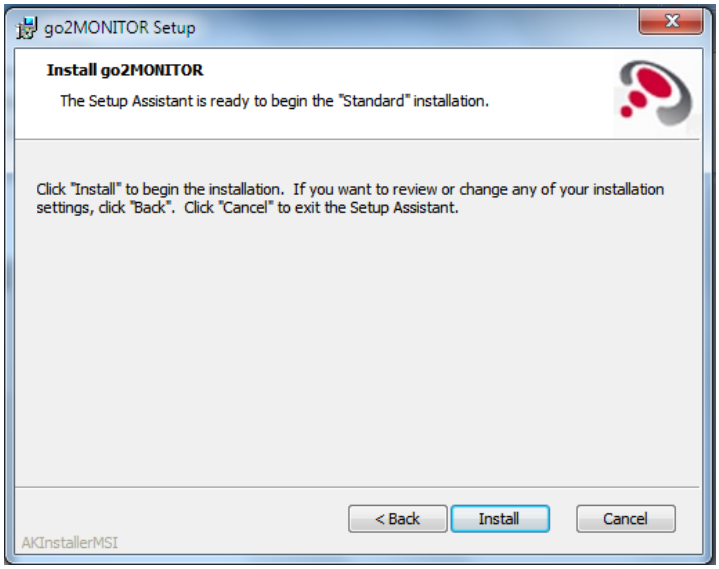


Figure 4: Standard Installation

Click on <**Install**> to continue the installation.

The WibuKey installation starts automatically. Depending on the language setting of your operating system the language in the following dialogs may vary.

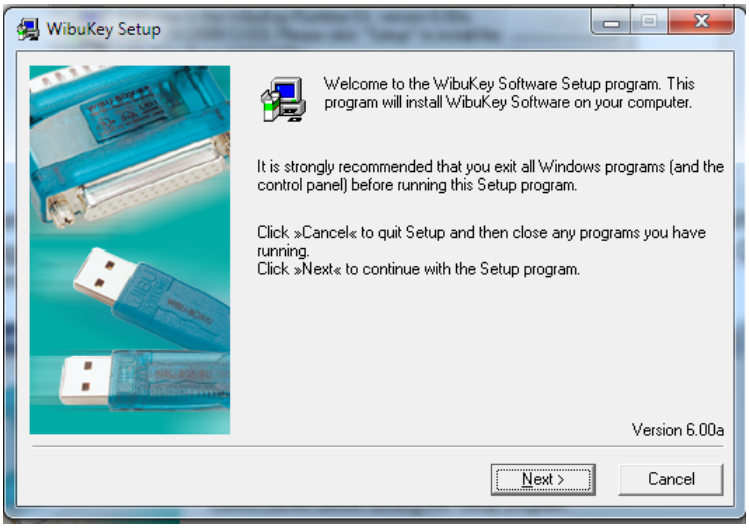


Figure 5: WibuKey Setup

Read the text and click on <**Next**>.

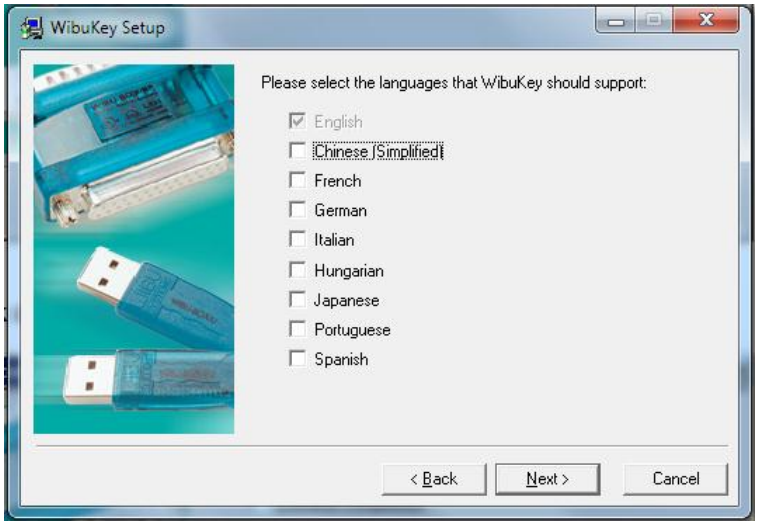


Figure 6: Select Language for WibuKey

Select the required languages and click on <**Next**>.

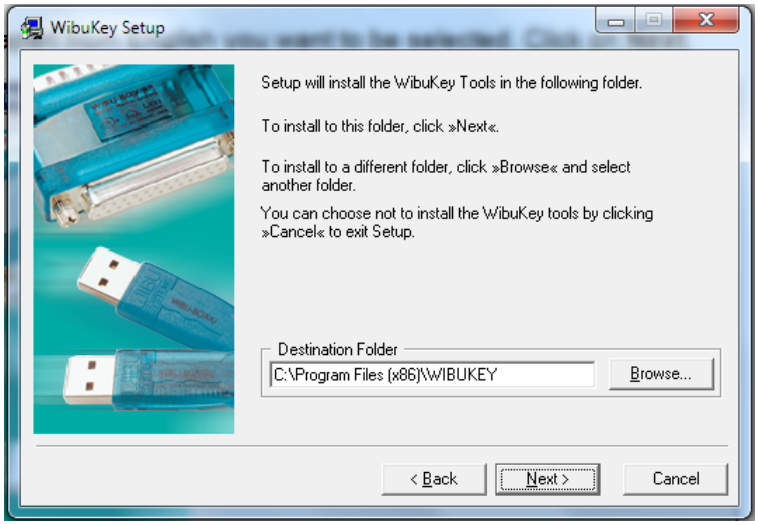


Figure 7: Select Installation Folder

Specify the target directory for the WibuKey tools and click on <**Next**>. If the folder does not exist, the following message is displayed:

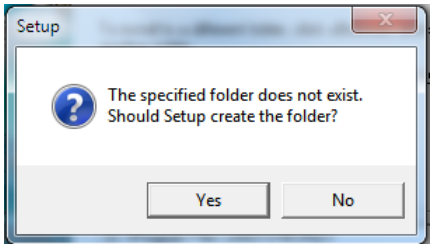


Figure 8: Create New Folder for WibuKey Installation

Accept to create the required folder with <**Yes**>.

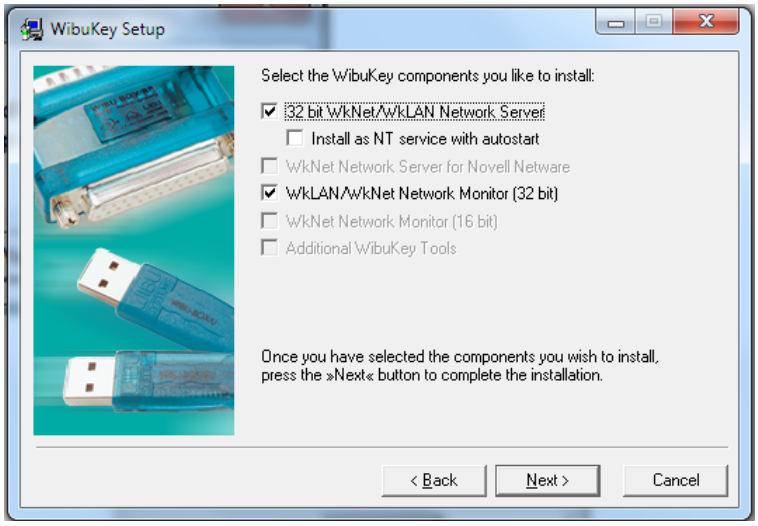


Figure 9: Select WibuKey Components

Click on <**Next**> to continue the installation.

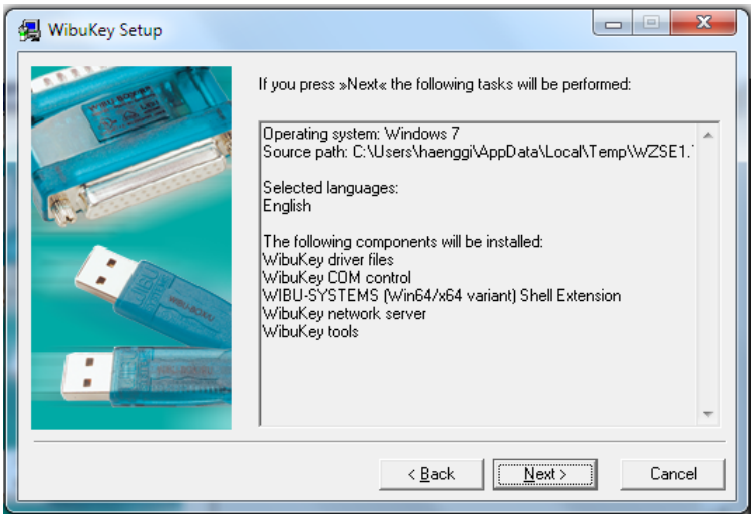


Figure 10: WibuKey Installation Tasks

Accept the installation tasks with a click on <**Next**>.

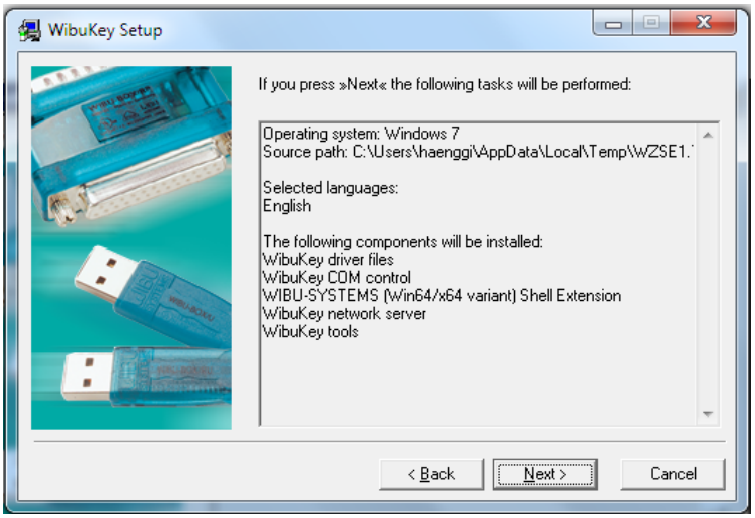


Figure 11: Confirmation Installation Tasks Finished

After all tasks have been finished, click on <**Next**>.

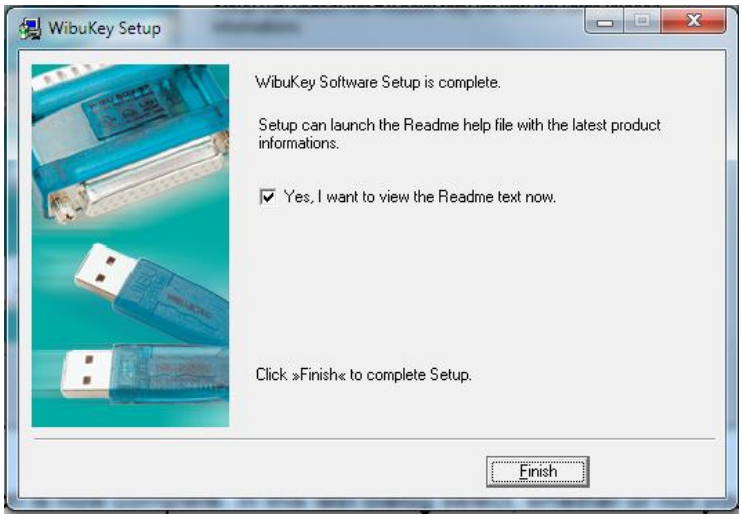


Figure 12: WibuKey Installation Finished

The WibuKey installation is now complete. In this last dialog select if you want to read the help file. Click on <**Finish**>.

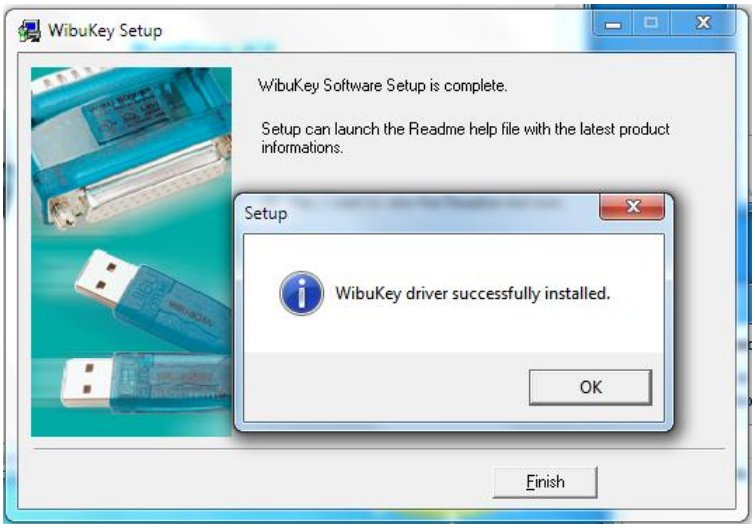


Figure 13: Help File of the WibuKey and Confirmation of Successful Installation

Click on <**OK**> to continue with the installation of the application.

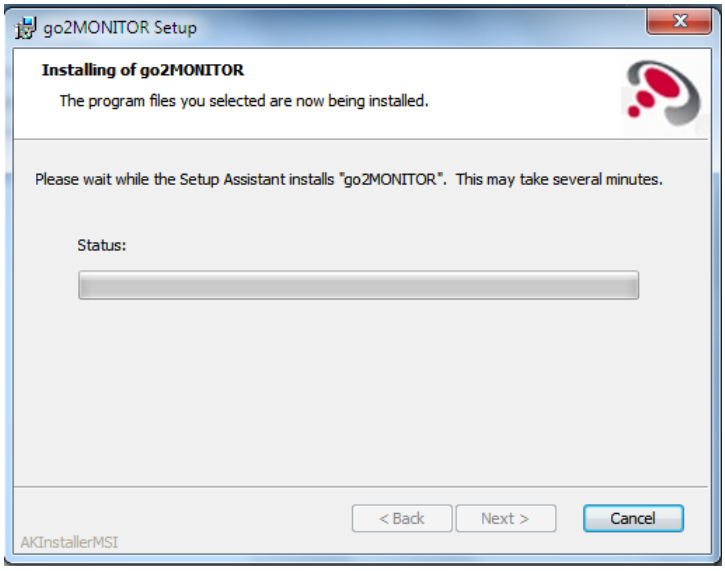


Figure 14: Progress of go2MONITOR Installation

After successful installation the setup assistant displays the following message:

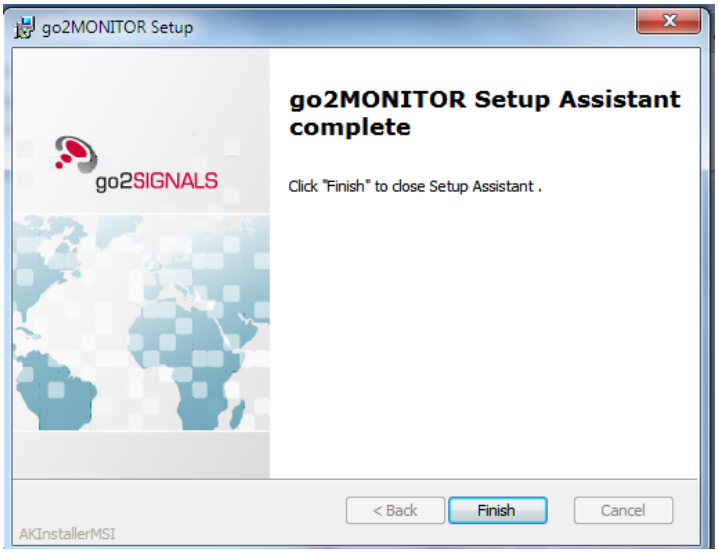


Figure 15: Successful Installation of the Application go2MONITOR

Click on <**Finish**> to exit the setup.

Connecting the Dongle

Once the installation is finished connect the dongle you received to an USB port. In case the dongle has already been connected, remove it from the port and reconnect.

You can run the application go2MONITOR only with a connected dongle.

License

The dongle is part of the software's copy-protection. Through the combination of an USB-dongle and a license-file the application can be installed on more than one PC, but can at a given time run only on the PC to which the dongle is connected.

A key is coded into the Wibu-dongle. The license file, with the extension maw, holds information about the functionality which is available due to the license paid. It has to be installed on each PC on which the application is supposed to run. At run-time, the application compares the information coded into the license-file with the dongle and unblocks the selected software if they are consistent.

The license-file default.maw is located in the go2MONITOR-related subfolder of the user directory.

```
C:\Users\<your user name>\go2SIGNALS\go2MONITOR v.n\default.maw
```

Signal Sources

This chapter describes the necessary configurations to use external receivers or streams as an input for go2MONITOR .

Alternatively recordings can be played back for off-line signal processing.

We recommend to use recorded files (provided by go2SIGNALS) to get familiar with the software.

Receiver Setup

Receivers are controlled by the **Receiver Control Module** (RCM). The configuration takes place in the receiver.conf file.

For the list of receivers supported by go2MONITOR see: Supported Receivers.

The default receiver.conf file is located as a read-only file in the go2MONITOR installation directory, e.g.:

```
C:\Program Files (x86)\go2SIGNALS\go2MONITOR
```

It is not used by the software and should never be edited. It is copied to the user directory during the first program start or if the file is is missing. It can be used to restore the original state in the user directory if needed.

Configuration

The **receiver.conf** file used by the application is located in the user directory of the current go2MONITOR installation, i.e.:

```
c:\Documents and Settings\<your user name>\go2SIGNALS\go2MONITOR
--or--
C:\Users\<your user name>\go2SIGNALS\go2MONITOR
```

The configuration is stored in a XML-file. It can be edited with a text editor, but be carefull as the correct XML-syntax must be kept.

Attention: We strongly recommend an XML editor, like Notepad++ or Notepad2, to avoid errors, since XML editors apply syntax highlighting and checking!

In the file some keys can be edited to enable or disable the support for certain receivers or to define receiver parameters like IP-address, control port etc. After making changes in the configuration file, restart go2MONITOR to apply the new settings.

The receiver.conf contains a sample configuration for each supported receiver. Only the first receiver in the default list is enabled, all other receivers are commented out and therefore inactive.

To use a specific receiver you have to uncomment the corresponding section in the file.

```
Commented sections start with: <!--
Commented sections end with: -->
```

To enable the selected receiver, uncomment the related section. To do so, either remove both start and end comment markers, or extend both markers so that each forms a string which combines both markers, that is "<!---->", exactly 4 hyphens!

```
<!-- ****************** WinRadio G331DDC ***************** -->
<!--
<Receiver000>
 <add key="RcvType" value="EXTIO"/>
 <add key="Name" value="Winradio-G31DDC"/>
 <add key="AuxInfo" value=""/>
 <add key="CtrlIfc" value="EXTIO"/>
 <add key="DSPChannel" value="AUTO"/>
 <add key="DLL" value="$_APP_PATH_$ExtIO_G31DDC.dll"/>
 <add key="StartFrequency" value="25000000"/>
 <add key="ShowGui" value="0"/>
 <SigIfc>
  <add key="NumberOfIfcs" value="1"/>
  <Ifc000>
   <add key="IfcType" value="EXTIO"/>
   <add key="MixerFreq" value="0"/>
   <add key="NetOutRate" value="40000000"/>
   <add key="PortReZF" value="61001"/>
   <add key="PortCxZF" value="60301"/>
  </Ifc000>
 </SigIfc>
 <Capabilities>
  <add key="Type" value="static"/>
  <add key="CustomGuiAvailable"     value="1"              />
  <FrequencyRanges>
   <add key="FR1" value="9000.0  49900000"/>
  </FrequencyRanges>
  <Bandwiths>
   <add key="BW1" value="40000.0"/>
   <add key="BW2" value="80000.0"/>
   <add key="BW3" value="125000.0"/>
   <add key="BW4" value="160000.0"/>
   <add key="BW5" value="400000.0"/>
   <add key="BW6" value="800000.0"/>
   <add key="BW7" value="1000000.0"/>
   <add key="BW8" value="1250000.0"/>
   <add key="BW9" value="1500000.0"/>
   <add key="BW10" value="2000000.0"/>
  </Bandwiths>
  <SampleRates>
   <add key="SR1" value="50000.0"/>
   <add key="SR2" value="100000.0"/>
   <add key="SR3" value="160000.0"/>
   <add key="SR4" value="200000.0"/>
   <add key="SR5" value="500000.0"/>
   <add key="SR6" value="1000000.0"/>
   <add key="SR7" value="1250000.0"/>
   <add key="SR8" value="1666667.0"/>
   <add key="SR9" value="2000000.0"/>
   <add key="SR10" value="2500000.0"/>
  </SampleRates>
  <Attenuations>
   <add key="Att1" value="0 -3 -6 -9 -12 -15 -18 -21"/>
  </Attenuations>
 </Capabilities>
</Receiver000>
-->
```

Figure 16: Commented WiNRADiO-Receiver

The configuration of a single receiver always starts with <Receiver**000**> and ends with </Receiver**000**>.

The receiver (WiNRADiO-G31DDC) in the preceding screenshot is commented out as it is surrounded by the comment markers.

The following figure shows an active IZT-receiver and inactive EM100 and Perseus receivers in short form.

```
27    <Receiver000>
28      <add key="RcvType"      value="IZT R3000"          />
29      ...                     ACTIVE
30    </Receiver000>
31
32  <!--
33    <Receiver000>
34      <add key="RcvType"      value="EM100""             />
35      ...                     INACTIVE
36    </Receiver000>
37  -->
38
39  <!--
40    <Receiver000>
41      <add key="RcvType"      value="Perseus"            />
42      ...                     INACTIVE
43    </Receiver000>
44  -->
```

Figure 17: Example Receiver Configuration

Remove the comment markers from the receiver section you wish to use.

Attention: Do not forget to comment the receiver which was active before!

The following settings have to be changed in the file *receiver.conf* to adapt it to your specific receiver and its parameters.

LAN receivers

To connect to a receiver over LAN-interface you have to provide the IP-address and control port of the receiver (see below for GEW GRX-LAN exception).

```
<add key="IPAddr"       value="127.0.0.1"          />
<add key="Port"         value="8600"               />
```

Consult the receiver handbook if you would like to know the default IP-address or change the IP-address of the receiver. Als0 check if DHCP is enabled and available.

LAN

Make sure that the receiver and the computer (running go2MONITOR) can communicate together.

In case of problems try to ping the receiver from the computer.

R&S EM100 Receiver

The following line in the file *receiver.conf* :

```
<add key="ComInterface" value="10.0.0.120" />
```

has to be changed to contain the local IP-address of the network interface where EM100 is connected (IP-address of the go2MONITOR computer).

GRX-LAN Receiver

The following block in the file *receiver.conf* has to be edited:

```
<add0>
     <add key="ID" value="0"/>
     <add key="Name" value="IP_ADDRESS"/>
     <add key="Value" value="10.0.0.1"/>
</add0>
```

Instead of the “10.0.0.1” address, the actual IP-address of the receiver has to be entered.

USB Receivers

No further configuration is necessary for receivers with USB interface. Make sure that the USB-drivers are installed properly. Also check the connection between receiver and PC.

Attention: Save the configuration file in your user directory after editing and restart go2MONITOR to apply your changes.

Multiple Receivers

It is possible to show multiple receivers in the input selector. To do so, all required <ReceiverXXX>…</ReceiverXXX> sections of the file *receiver.conf* have to be uncommented.

Attention:

- The receiver numbers of all uncommented receiver sections (XXX number in <ReceiverXXX> tag) have to be changed to form a consecutive range, for example:

```
<Receiver000>
…
</Receiver000>
<Receiver001>
…
</Receiver001>
<Receiver002>
…
</Receiver002>
```

- The following key has to be changed to contain the total number of used receivers:

```
<add key="NumberOfReceivers"    value="3" />
```

- The following key has to be adapted to **each** receiver in use to provide a unique TCP-port. The receiver Receiver000 must use port 60301, Receiver001 must use port 60302 etc.

```
<add key="PortCxZF"       value="60301" />
```

Streaming Sources

go2MONITOR can also use TCP/IP-based streams as its input. The supported format is compatible with other products available from the PLATH group.

The streaming format description can be provided upon request.

Stream configuration is setup in the file *StreamInputs.conf*.

The default StreamInputs.conf file is located as a read-only file in the go2MONITOR installation directory, e.g.:

```
C:\Program Files (x86)\go2SIGNALS\go2MONITOR
```

It is not used by the software and should never be edited. It is copied to the user directory during the first program start or if the file is is missing. It can be used to restore the original state in the user directory if needed.

Configuration

The **StreamInputs.conf** file used by the application is located in the user directory of the current go2MONITOR installation, i.e.:

```
c:\Documents and Settings\<your user name>\go2SIGNALS\go2MONITOR
--or—

C:\Users\<your user name>\go2SIGNALS\go2MONITOR
```

The configuration is stored in a XML-file. It can be edited with a text editor, but be carefull as the correct XML-syntax must be kept. Again, we strongly recommend an XML editor, since these editors apply syntax highlighting and checking.

This configuration file can be edited to add new sources or to change parameters like IP-address, port etc. After making changes in the configuration file, restart go2MONITOR to apply the new settings.

The sample configuration file contains several examples for stream input from other applications:

```
<?xml version="1.0" encoding="utf-8" ?>
 <configuration>
<appSettings>
  <SignalInput_0>
    <add key="Type" value="STREAM" />
    <add key="IP"value="127.0.0.1" />
    <add key="Port" value="44001" />
    <add key="DisplayName" value="go2DECODE/DANA stream" />
  </SignalInput_0>

  <SignalInput_1>
    <add key="Type" value="STREAM" />
    <add key="IP"value="127.0.0.1" />
    <add key="Port" value="60100" />
    <add key="DisplayName" value="go2RECORD stream" />
  </SignalInput_1>
</appSettings>
</configuration>
```

This configuration file defines two streaming sources in sections

- <SignalInput_0>...</ SignalInput_0>
- <SignalInput_1>...</ SignalInput_1>

To add new streaming sources, add further tags:

- SignalInput_2, SignalInput_3,…

Each SignalInput_X tag can contain the following parameters:

```
<add key="Type" value="STREAM" />: mandatory, the type is always "STREAM"
<add key="IP"value="127.0.0.1" />: mandatory, the IP address of the streaming source
<add key="Port" value="60100" />: mandatory, the TCP port of the streaming source
<add key="DisplayName" value="go2RECORD stream" />: mandatory, the descriptive name of the source which will be displayed in the GUI
<add key="Cut" value="500000" />: optional, the effective bandwidth of the input signal
```

Overview

Display

Signals are shown in two ways:

- The wideband spectrum display is the actual FFT of the frequency range under observation
- The wideband spectrogram shows the frequency occupation over a certain period (waterfall, sonogram)

The wideband spectrum and spectrogram are configurable.

Signal Selection

Using the spectrum or spectrogram view the operator selects signals for further processing. For each selcted signal a Digital Down Conversion (DDC) applied.

The output of a DDC is assigned to a production channel and the additional channel view displayed.

Alternatively, the wideband classification results can be used to select signals of interest. Modulation, bandwidth, symbol rate, shift and other parameters are displayed for all classified signals within the wideband frequency range.

Production Channel

A production channel features a detailed display of the selected narrowband signal. The narrowband spectrum and spectrogram are configurable.

A production channel provides different operating modes:

- **Classification**, the signal is continuously classified
- **Decoding**, the signals is decoded using a manually selected decoder
- **Recognition and decoding**, the signal will be decoded automatically using a modem list
- **Classification, recognition and decoding**, suitable decoders will be automatically selected depending on the classification result

Depending on your license up to eight production channels can be used in parallel.

The result view is configurable using XSLT (Extensible Style sheet Language Transformation).

Main Screen

Start the software either from the Windows Start menu or by double clicking the go2MONITOR program icon on the desktop. The software will come up with its main screen, the spectrum and the spectrogram.

If the application was restarted, then the software will try to apply the settings in use when the application was stopped. Example: If the station list was available it will be opened again on the same position.

The wideband spectrogram has the function of a control center for the software. The operator can control the receiver, select the signals and perform further analyses like classification or decoding on these signals with a simple double click. As a first step a rough classification on all signals within the selected bandwidth can be performed. Depending on the result, signals can be selected for decoding.

In the following figure the screen is divided into the following parts:

- Menu bar with menu File, View and Help
- Control elements for spectrogram and spectrum
- Spectrogram and spectrum
- Receiver control
- Status bar at the bottom

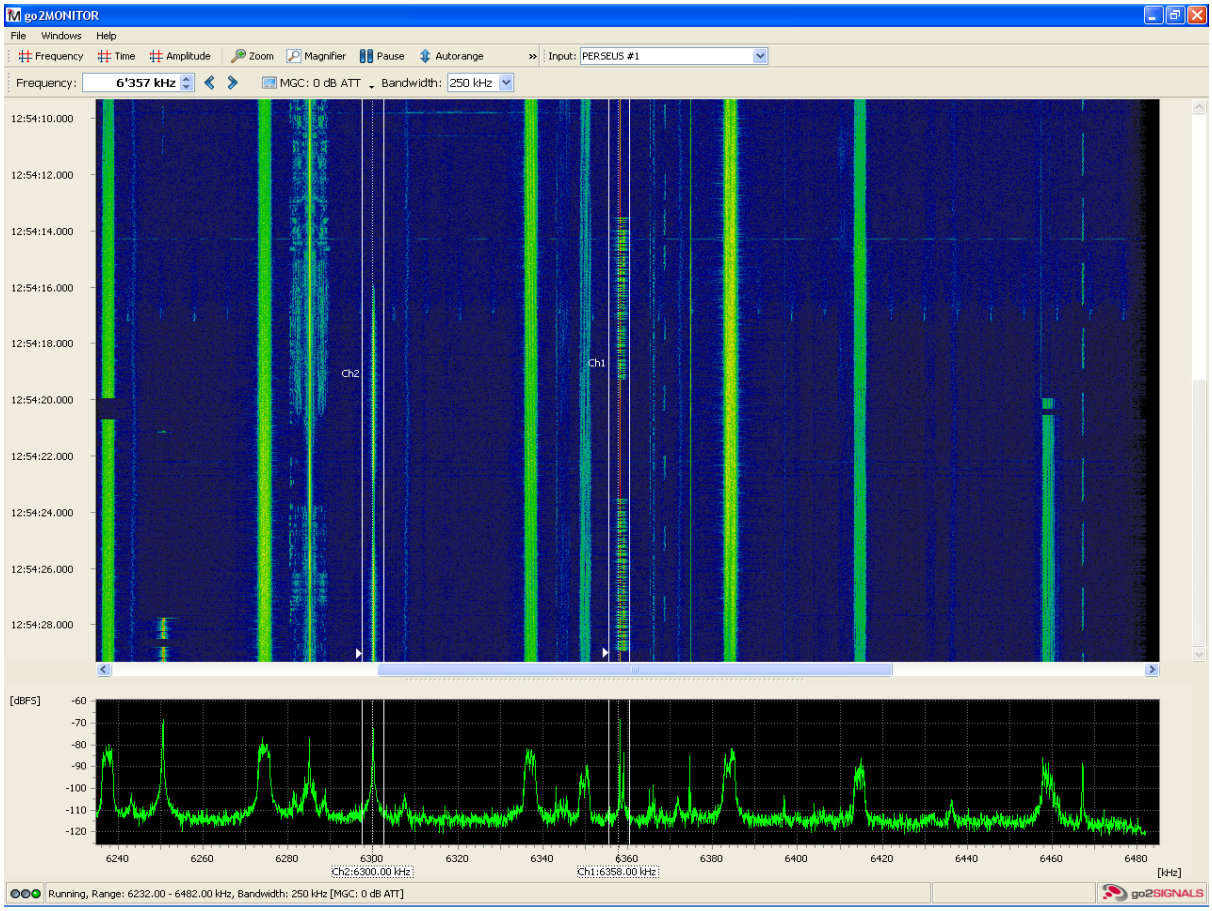


Figure 18: Main Screen with Spectrogram and Spectrum

The functions of these menus will be described in the next chapters.

Three status lights are located on the left side of the status bar at the bottom of the main screen. They give information about the input of a wideband signal.

Light	Meaning
	Error: No wideband signal or no input file available
	Waiting for signal
	Wideband signal available

Table 1: Status of Signal Input

The text field of the status bar on the bottom of the window displays information about the status of the software. If a receiver is connected, the settings of the receiver including the frequency range, total bandwidth and attenuation are displayed.

Main Menu

File Menu

Saving a Configuration

In the menu **File/Save channel configuration** the current settings can be stored in a configuration file. This file contains all parameters which have been setup in the channels like center frequency, bandwidth, mode, decoder list etc. For saving the configuration you have to enter a valid file name. The directory for the storage can be anywhere on the computer in use or on the network.

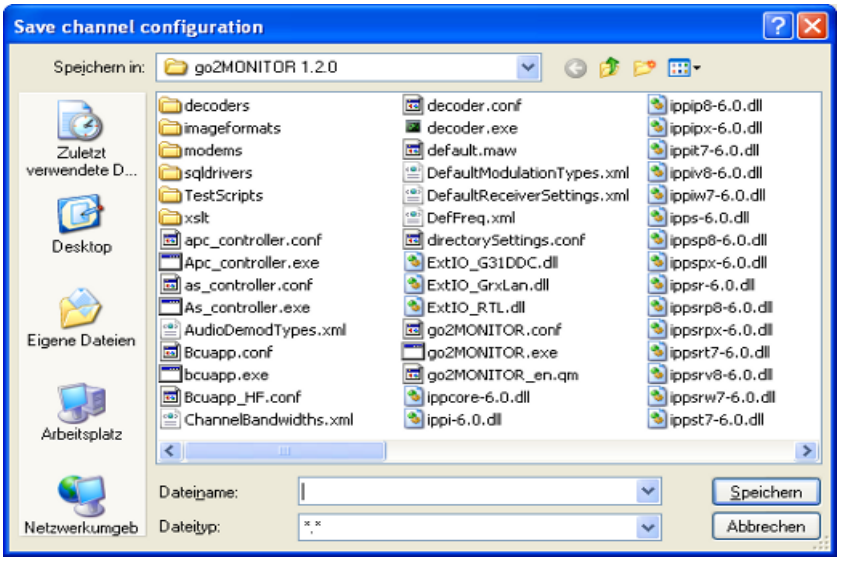


Figure 19: Save Channel Configuration

Loading a Configuration

In the menu **File/Load channel configuration** the settings of a previously stored channel configuration can be loaded into go2MONITOR. The configuration file contains the information to setup the all the channels and their parameters like frequency, bandwidth, mode etc.

Attention: The receiver has to operate within the correct frequency range which is defined in the receiver.conf file. Otherwise the status bar will display a message “frequency out of range”. As soon the receiver is tuned to the correct frequency, the wideband spectrum and spectrogram will start.

Select the directory and the file where you saved the configuration and click <**Open**>.

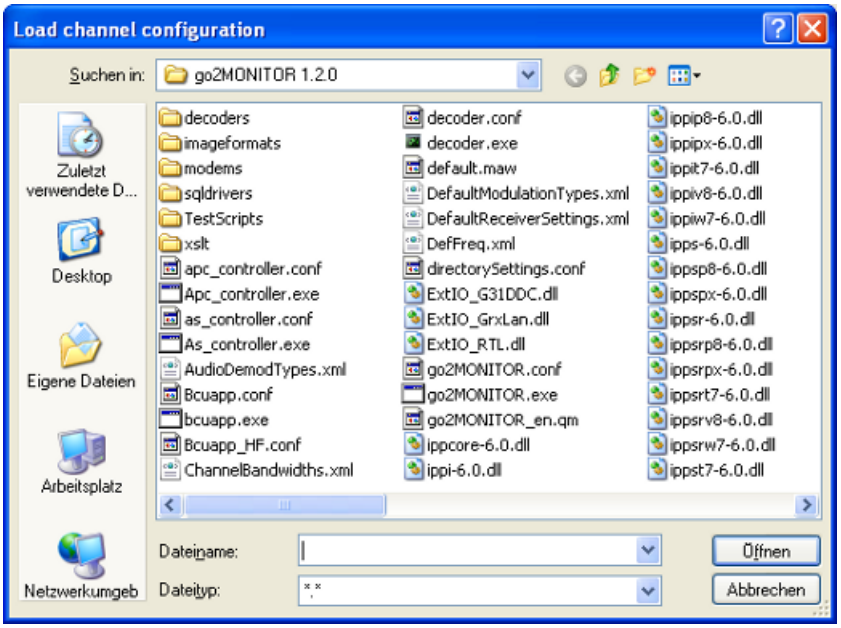


Figure 20: Load Channel Configuration

Modem List Editor

In the menu **File/Modem list editor** can be selected for creating and setting up specific modem lists. The modem list contains a selection of all modems which are available for the application. With the modem list editor, lists can be created, deleted or copied.

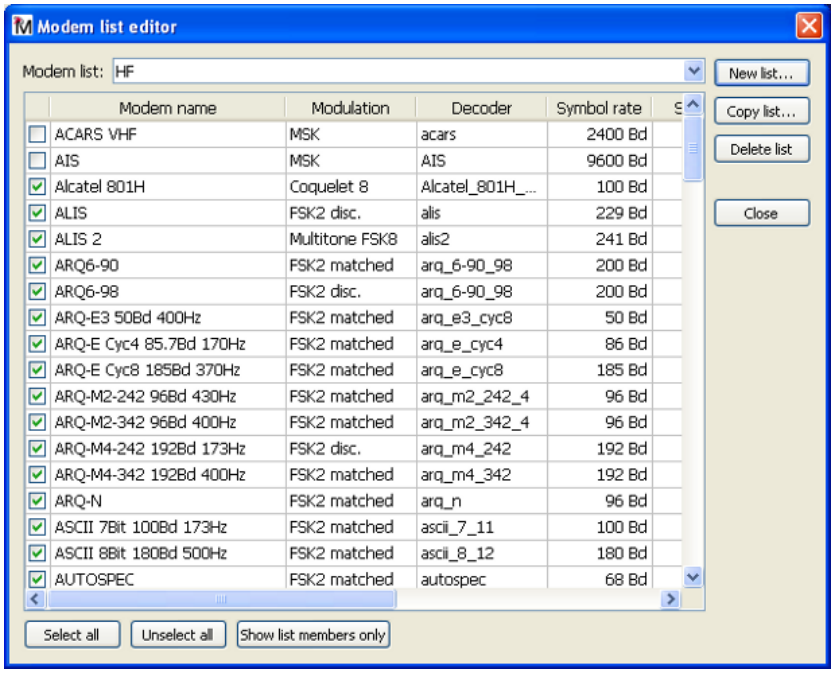


Figure 21: Modem List Editor

If you need to create a new list, click <**New list…**>. A new window opens and you can enter the name of the new list.

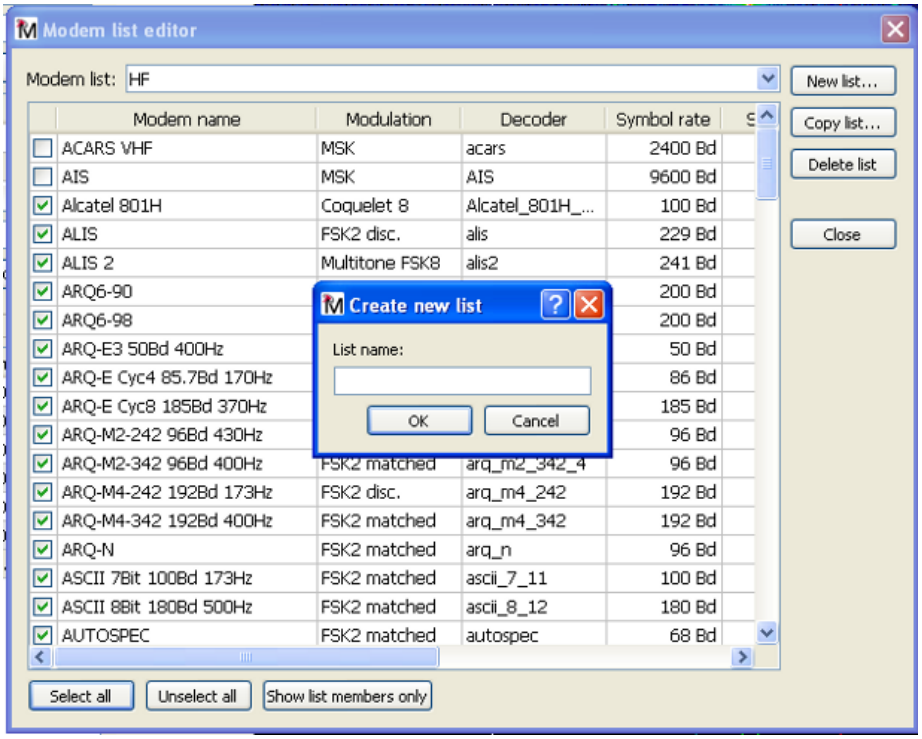


Figure 22: Create New Modem List

After entering the name, select the modems which required in the new list. Close the window to store the modems in the list.

This function is useful to generate lists depending on the actual job or for groups of signals. Performance is improved if the search is restricted to MFSK modems when a MFSK signal is detected.

ver Files

All parameters (like displayed name, speed, shift etc.) are stored in specific **.ver* files. The software retrieves these parameters from this XML file to build up the modem list and set up the demodulator and decoder. For additional details see “ver files” on page 75.

Settings…

In the **Settings** window general parameters can be set.

Group	Setting	Description
General		
	Language	Actually only English is supported
	Display text next to icons in main toolbar	If enabled a text explaining the function of each icon is displayed in the toolbar.
Channels		
	Default Mode	Select the default mode to be used if if a new channel is opened. Available are: Classification, Decoding, Recognition + Decoding, Classification + Recognition + Decoding
	Automatic delay in “Classification + Recognition + Decoding”	Automatically buffer the signal (delay) between the Spectrogram and the DDC channel. This gives you the chance to start the decoding from the beginning of the transmission even if you lost some time in the detection.
	Channel grid in spectrogram	Grid used if you select a channel by double-click or by moving the center line in the spectrogram.

Group	Setting	Description
Decoder results	Font	Select the font used for the text output (font, font style, size, effects and writing system).
	Reset Font	Reset the font to Courier New, 8
Channel markers		
	Color	Select the color used to mark the channel in the spectrogram
	Line width	Select between single, double or triple width of the lines used to mark the channel in the spectrogram
Recordings	Default directory for recordings	Select the directory where recordings are stored.
	Set to default	Sets the recording path to the user directory
	Use generated file name Ask for the file name	Choose between automatically generated file names (Date__frequency_bw) or if you like to define each time a filename.
Buttons		
	OK	Accept all changes and close the window
	Set defaults	Restore default settings
	Cancel	Close window without saving.

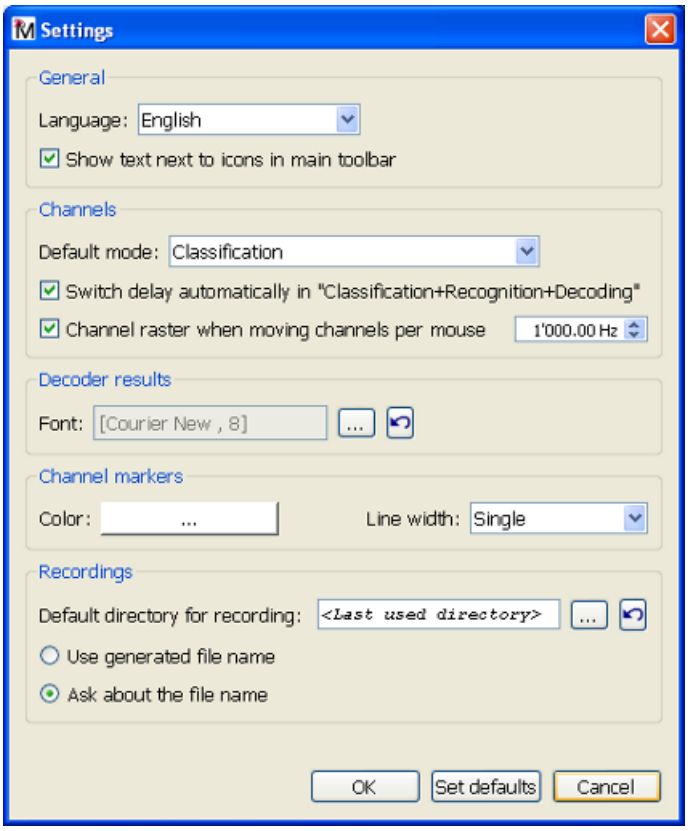


Figure 23: Settings Window

Views Menu

From the menu **Views** different windows can be opened:

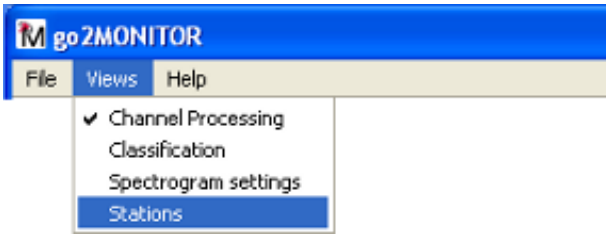


Figure 24: Main Menu "Views"

All views can be attached to the main window or be separated into a single window by drag-and-drop. For example in a two monitor system the channel window displaying 1, 4 or 8 channels can be moved to a second monitor.

Channel Processing

Display the channel window for narrowband classification, recognition, and decoding of waveforms.

Classification

Display the control and result window for the wideband classification

Spectrogram Settings

Display the control windows to set the parameter of the spectrogram and spectrum window

Stations

Display the station list.

Help Menu

Contents

Contents provides help (user manual).

About

Display the About screen.

Input Selection

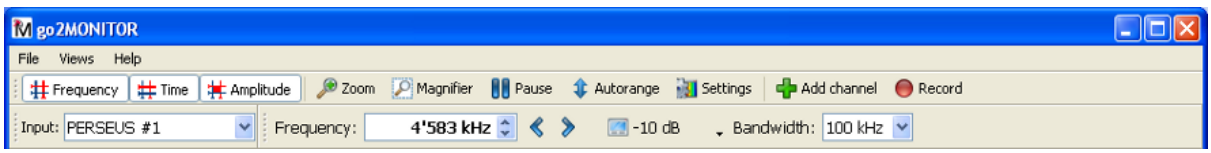


Figure 25: Input Selection Box

All defined receivers and streaming sources are displayed in the dropdown menu of the toolbar field **Input** of the GUI (starting with the receivers, followed by the streaming sources and the file) and can be selected at any time.

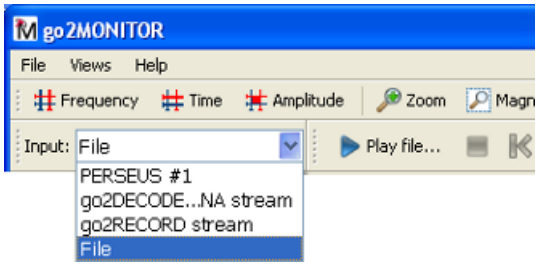


Figure 26: Input Selection

File Input

When selecting a File as input, the toolbar will provide functions according to the following figure.

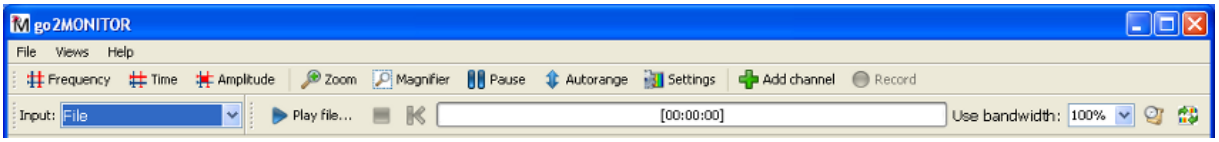


Figure 27: File Input Functions

A mouse click on the button <**Play File**> opens the **Add signal files** dialog.

Open

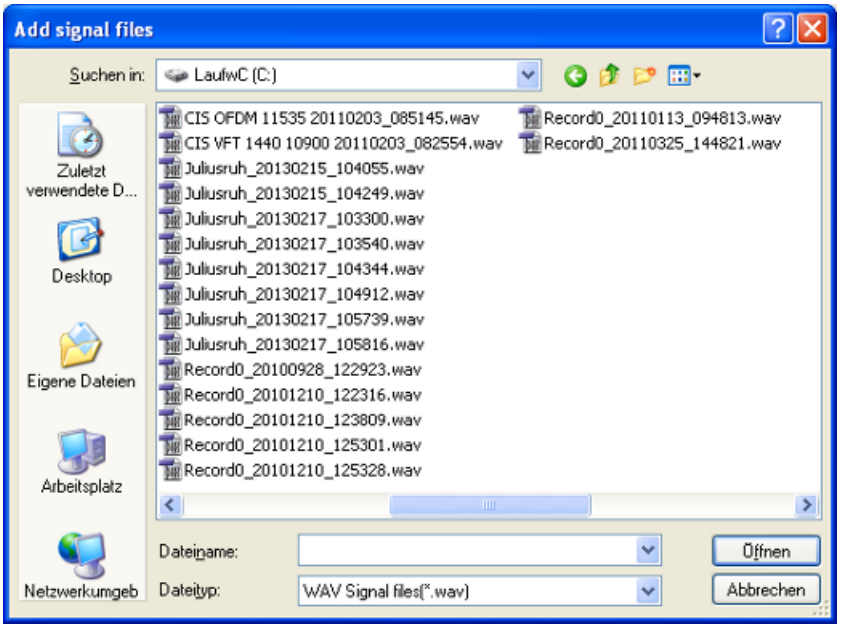


Figure 28: Add Signal Files Menu

You can select a wav file. If you press <**Open**>**,** the file is transferred into the internal input buffer.

Wav File Drag-and-Drop

You can load a .wav file by drag-and-drop. To do so, open the explorer, select a valid .wav file and drag it to the area of the progress bar. You can see the format of the mouse cursor change. If the + sign appears at the lower end of the arrow cursor you can drop the file. Playback will start immediately. The name of the file is displayed in the progress bar.

Play File Toolbar

When the *.wav* file is replayed the following functions are possible:

Button	Description
Play file...	A mouse click on the button Play File opens the Add signals dialog. The file will be played in a loop until the Stop button has been used.
Pause	This button will pause the playback of the file.
	This button will stop the playback of the file and delete it from the memory
	This button will start the playback at the beginning of the file.
Use bandwidth: 100%	With this dropdown box you can select which bandwidth of the recorded spectrum is used for the replay function. I.e. a value of 50% will reduce a bandwidth of 200 kHz to 100 kHz display bandwidth. With the slider between the spectrogram and spectrum you can move within the total frequency range of the replayed file.
	When playing back a file the time of the computer will be display on the left hand side of the spectrogram. A click on this button will take the time from the replayed file on the left side of the spectrogram
	This button will mirror the signal display. If there has been a carrier on the left side of the center frequency it will be moved to the right side of the center frequency. This function will help to display the correct spectrum and spectrogram when files have been recorded with a converter.

Table 2: Functions File Replay

Direct Jump to Position

When the .wav file is played you can click to any position of the progress bar. The replay will start directly at the selected position of the bar.

Receiver Input

When selecting a receiver as input, the toolbar will provide functions according to the following figure.

For the setup of additional receivers see “Receiver Setup” on page 13.

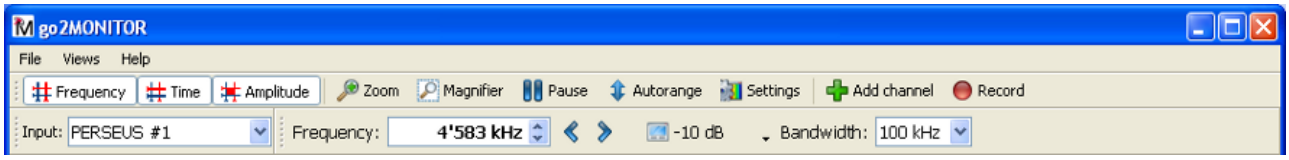


Figure 29: Receiver Control

Setting a Center Frequency

The center frequency for a receiver can be entered directly as a value into the field **Frequency**.

If a frequency has been entered into this field it is possible to tune the frequency in steps related to the selected bandwidth with the two arrows on the right side of the frequency field. The left arrow will tune the frequency to a lower value, the right arrow to a higher value.

It is also possible to tune the frequency with the mouse wheel. For this function you have to place the mouse cursor on the right side of the digits. Moving the mouse wheel will also change the frequency up and down.

Setting the Receiver Bandwidth

The bandwidth of the overview spectrum can be set with the **Bandwidth** dropdown box. You will be provided different bandwidth values and can select one of them.

Setting the Receiver Attenuation

Strong signals close to the signal to be demodulated can cause intermodulation. To avoid this type of interference, the receiver input can be attenuated. Attenuation can be selected with the gain dropdown box. The range depends on the receiver. 0 dB corresponds to no attenuation, -30 dB corresponds to high attenuation.

Selecting a Frequency for a Channel

You can select any signal by a double click and transfer it to a channel. This is described in chapter "Spectrum and Spectrogram" on page 31.

Stream Input

When selecting a stream as input, the toolbar will provide no additional functions.

For the setup of additional stream see "Streaming Sources" on page 16.

TBD

Figure 30: Stream Input

Spectrum and Spectrogram

Overview

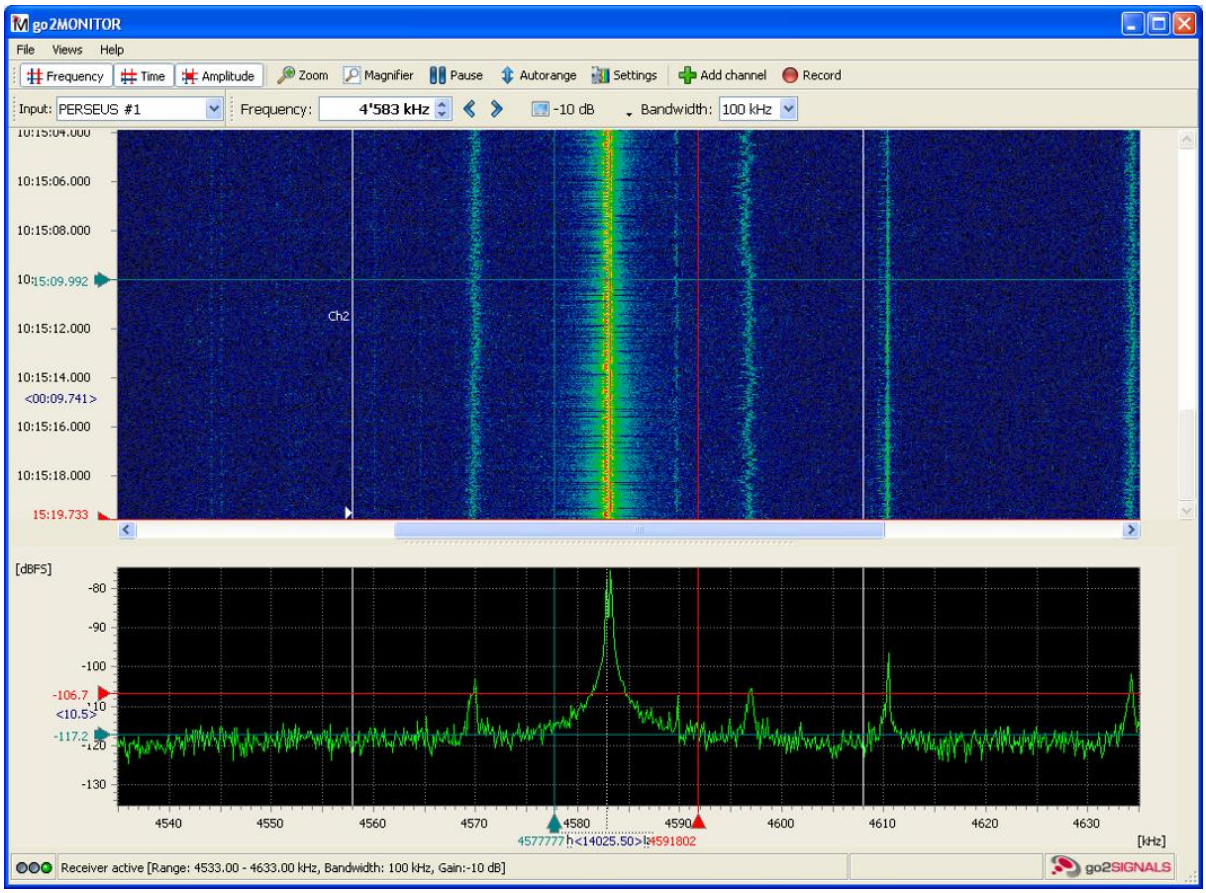


Figure 31: Spectrum and Spectrogram

The window displays all the signals within the selected receiver bandwidth. The upper part displays the spectrum and the lower part the spectrogram. Moving the splitter between the two parts varies the ratio.

Main functions can be called from the menu bar at the top of the window.

Button	Description
Frequency	This button will display frequency cursors for spectrum and spectrogram. The number of cursors and type is dependent on the setting in the spectrogram settings.
Time	This button will display two time cursors in the spectrogram window.
Amplitude	This button will display two amplitude cursors in the spectrum window.
Zoom	When selecting the Zoom button the mouse cursor will change to a magnifier glass. You can move the magnifier to an interesting signal and click again. The selected frequency will be the new center frequency with the half bandwidth. If the total bandwidth of the spectrum or spectrogram is 100 kHz the result window will have a bandwidth of 50 kHz. A zoom out can only be done with the setting window.
Magnifier	You can select a rectangle area of the spectrogram and press the Magnifier button. The selected area will be displayed in a new window.
Pause	This button will pause the playback of the file.
Autorange	With this button the software will determine the best amplitude range for the spectrum and spectrogram.

Button	Description
Settings	This button will open the settings window for the spectrum and spectrogram.
Add channel	This button will start a channel and add it to the channel window. The center frequency of the channel will be the center frequency of the main spectrum.
Record	This button will start a wideband recording of the received or replayed signal. An explorer view will open to name the recorded file.

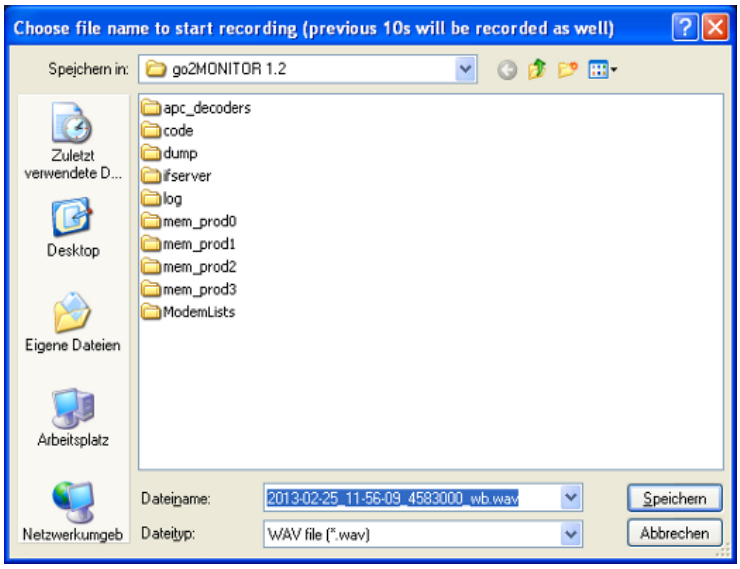


Figure 32: Explorer window for the recorded file

Table 3: Toolbar Functions

Spectrogram Settings

With a right click in the spectrum or spectrogram window the context menu for the spectrogram settings is displayed.

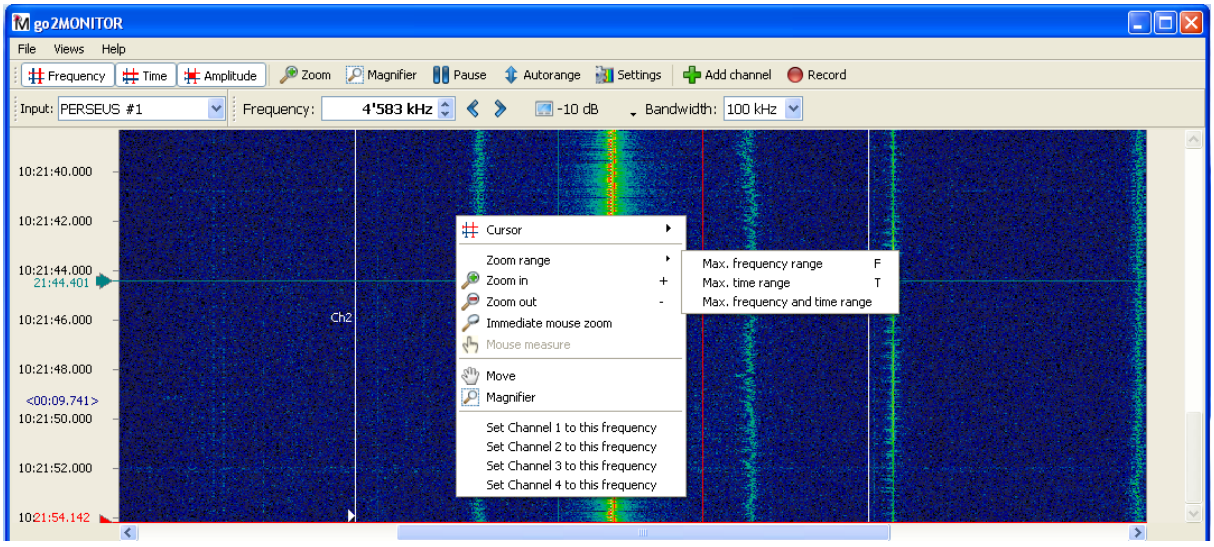


Figure 33: Spectrogram Settings – Context Menu

The following settings are possible with the context menu:

Context Menu	Sub Menu	Description
Cursor		
	X-Cursor	Displays the amplitude cursors.
	Y-Cursor	Displays the frequency cursors. The number of cursors is defined in the Spectrogram settings.
	Z-Cursor	Displays the time cursors. The number of cursors is defined in the Spectrogram settings.
	2 Cursor mode	Two cursors are displayed.
	Harmonic	All harmonic cursors will be displayed according the number of cursors specified in the Spectrogram settings.
	Mirrored	All harmonic cursors will be displayed according the number of cursors specified in the Spectrogram settings on the left and right side of a center cursor.
	Centered	
Zoom Range		
	Max. frequency range	The maximum frequency range will be displayed in the spectrum view.
	Max. time range	
	Max. time and frequency range	
Zoom in		When selecting Zoom in the selected frequency will be the new center frequency with the half bandwidth. If the total bandwidth of the spectrum or spectrogram is 100 kHz the result window will have a bandwidth of 50 kHz. A zoom out can only be done with the setting window.
Zoom out		This menu item will reverse on Zoom in step.
Immediate mouse zoom		
Mouse measure		
Move		When selecting the menu item Move the spectrum can be dragged to the left or right side.
Magnifier		After selecting a rectangle area of the spectrogram with this menu item a new window will be opened displaying the selected area.
Set channel 1 to this frequency		When selecting this menu item the channel 1 will be displayed. The frequency under the mouse cursor will be the center frequency of the channel window.
Set channel 2 to this frequency		When selecting this menu item the channel 2 will be displayed. The frequency under the mouse cursor will be the center frequency of the channel window.
Set channel 3 to this frequency		When selecting this menu item the channel 3 will be displayed. The frequency under the mouse cursor will be the center frequency of the channel window.
Set channel 4 to this frequency		When selecting this menu item the channel 4 will be displayed. The frequency under the mouse cursor will be the center frequency of the channel window.

Table 4: Context Menu Spectrogram

Spectrogram Settings - Parameters

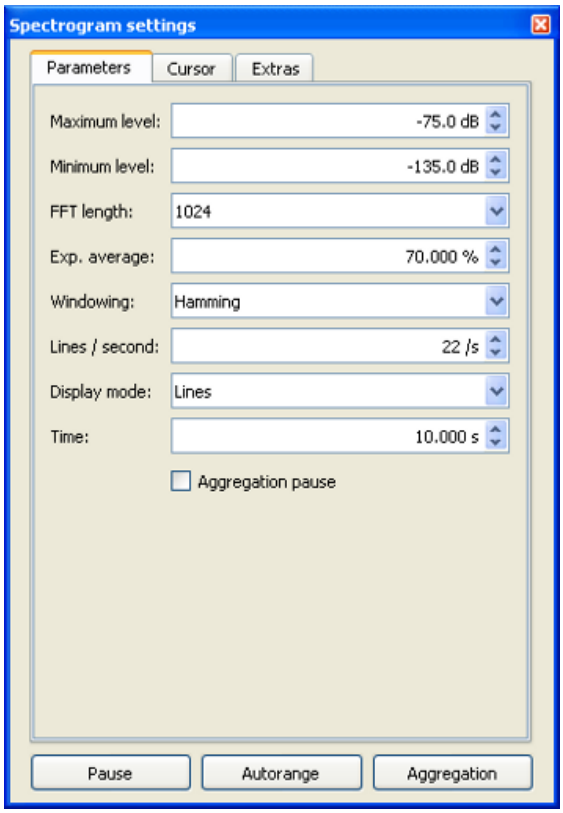


Figure 34: Spectrogram Settings - Parameters

In this window the parameters for the spectrogram can be set up.

Parameter	Description
Maximum level	Defines the maximum level of the display.
Minimum level	Defines the minimum level of the display.
FFT length	Number of values of frequency in which the signal is displayed. To get a higher resolution of the displayed frequency range, the FFT length should be increased.
Exp. average	The spectrum is displayed in average of several spectrums. The result of a change of the spectrum will be a total view of the spectrum. 0%: No average <80%: Low average 80% - 99%: High average 100%: No updating of the spectrum
Windowing	The FFT algorithm is used for the calculation of the spectrum. This algorithm indicates inaccuracies in the amplitude (attenuation) as well as in the bandwidth (expansion) of a signal due to the finite signal probe. These inaccuracies can be reduced using different windows.
Lines / second	Number of spectrums that can be calculated and displayed within one second. This parameter sets the time resolution for the spectrogram which is directly related to the scroll speed of the display.
Pause	In Pause, the display is stopped (not the signal processing). A change of parameters is possible for a more detailed analysis of the current signal.
Auto range	Automatic setting of the displayed range to view the total amplitude.
Aggregation	If activated the highest and average values are determined and displayed as a second curve in red color.
Aggregation pause	This check box will pause the aggregation

Table 5: Spectrogram Settings - Parameters

Spectrogram Settings - Cursor

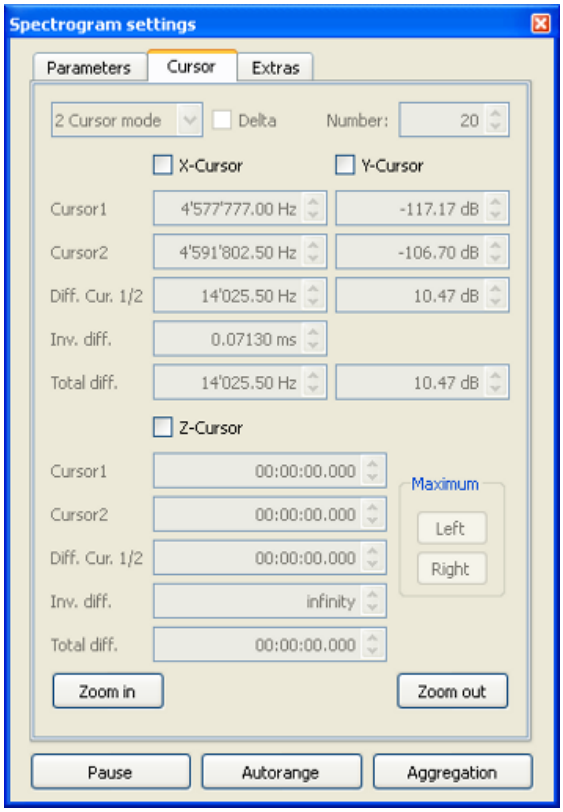


Figure 35: Spectrogram Settings - Cursor

In this window the cursor functions can be set up.:

Cursor		Description
X-Cursor		The cursors are activated/deactivated in X-direction. They are used to measure frequencies in Hz.
	Cursor1	Frequency for cursor 1
	Cursor2	Frequency for cursor 2
	Diff. Cur. 1/2	Frequency distance between cursor1 and cursor2
	Inv. diff.	Inverted difference is a function for direct time readout according to the formula 1 / [value in box Diff. Cur. 1/2]
	Total diff.	Frequency distance between the first and last cursor in 2 cursor mode, harmonic or mirror mode.
Y-Cursor		The cursors are activated/deactivated in Y-direction. They are used to measure the level of signals in db.
	Cursor1	Frequency for cursor 1
	Cursor2	Frequency for cursor 2
	Diff. Cur. 1/2	Frequency distance between cursor1 and cursor2
	Total diff.	Frequency distance between the first and last cursor in 2 cursor mode, harmonic or mirror mode.
Z-Cursor		The cursors are activated/deactivated in Z-direction. They are used to measure values of time.
	Cursor1	Time of cursor 1
	Cursor2	Time of cursor 1

Cursor		Description
	Diff. Cur. 1/2	Time difference between cursor 1 and 2
	Inv. diff.	Inverted difference is a function for direct frequency readout according to the formula 1 / [value in box. 1/2]
	Total diff.	Time distance between the first and last cursor in 2 cursor mode, harmonic or mirror mode.
Cursor Mode		
	2 Cursor mode	For measuring tasks two cursors are displayed at the same time.
	Harmonic	With this button a specific number of cursors defined by the spin box Number at equidistant intervals in the area delimited by cursor1 and cursor2 are displayed. This mode makes it i.e. easy to measure the frequency distance for multi frequency signals like MFSK.
	Mirrored	With this button a specific number of cursors defined by the spin box Number at equidistant intervals on the left and right side of cursor1 are displayed. The number off cursors should be odd.
	Center	
Delta		
Number		With this spin box the number of cursors is selected to be displayed in Harmonic or Mirror mode.
Maximum		
	Left	
	Right	
Zoom in		With enabled cursors, the button Zoom in permits to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by a factor defined by the Relative factor in the Spectrogram settings of the total bandwidth around the center frequency. Additionally, a rectangle can be drawn in the display window and you zoom into this section graphically.
Zoom out		Each time the button Zoom Out is activated the Zoom in function is reversed.
Pause		In Pause, the display is stopped (not the signal processing). A change of parameters is possible for a more detailed analysis of the current signal.
Auto range		Automatic setting of the displayed range to view the total amplitude.
Aggregation		If activated the highest and average values are determined and displayed as a second curve in red color.

Table 6: Spectrogram Settings - Cursor

Spectrogram Settings - Extras

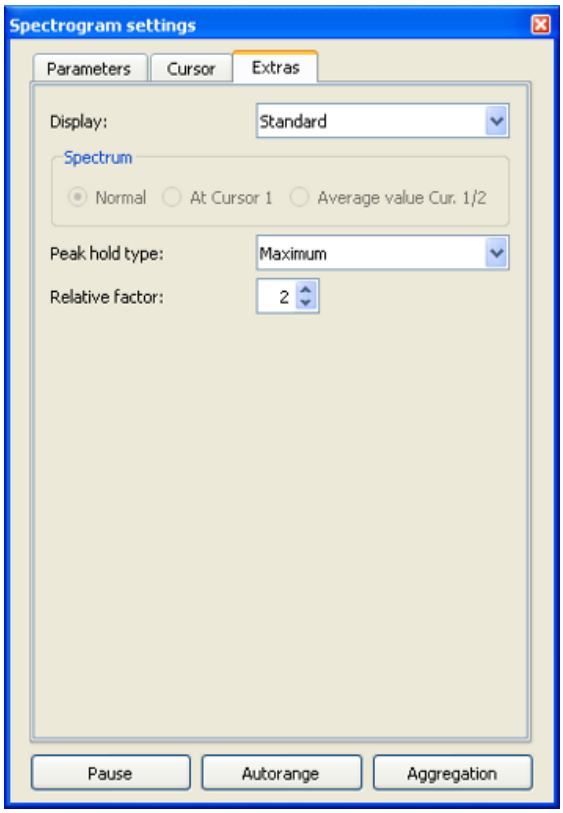


Figure 36: Spectrogram Settings - Extra

In this window different display types are selectable and the peak hold factor can be adjusted.

Item		Description
Display		
	Inverse	This item enables the invers color display.
	Standard	This item enables the standard color display.
	Monochrome	This item enables the monochrome color display.
Peak hold type		
	Maximum	This item aggregates the maximum values during aggregation time.
	Minimum	This item aggregates the minimum values during aggregation time
	Average	This item aggregates the average values during aggregation time
Relative factor		The relative factor is used for the zoom process to determine the zoom factor.
Pause		In Pause, the display is stopped (not the signal processing). A change of parameters is possible for a more detailed analysis of the current signal.
Auto range		Automatic setting of the displayed range to view the total amplitude.
Aggregation		If activated the highest and average values are determined and displayed as a second curve in red color.

Table 7: Spectrogram Settings - Extra

Magnifier

After selecting a rectangle area of the spectrogram with this menu item a new window will be opened displaying the selected area.

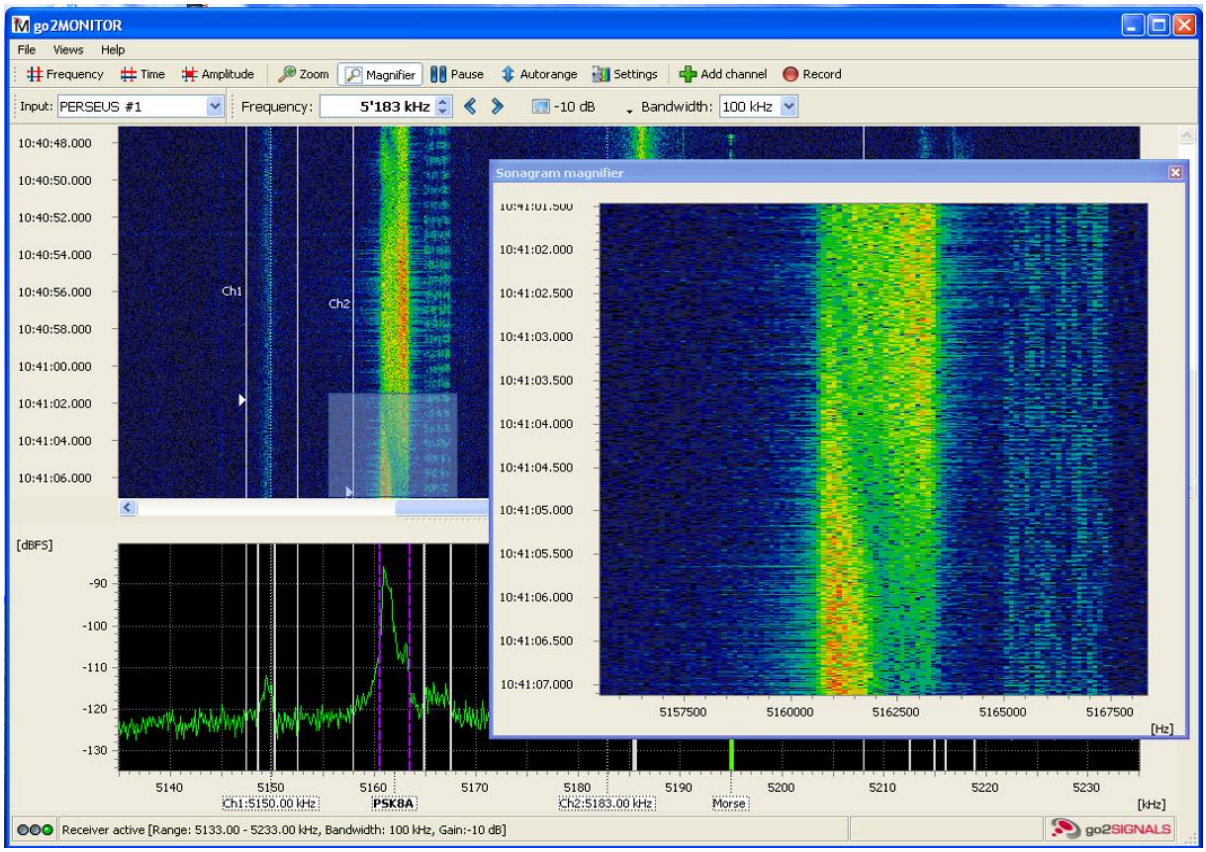


Figure 37: Magnifier

Classifier (Snapshot, Wideband)

General

The snapshot classifier detects all emissions within the reception bandwidth.
After the classification, the result list contains the following information

- Mode (Carrier, FSK2, MFSK, Morse, PSK, Voice, Unknown)
- Frequency
- Bandwidth
- Shift/Tone (Shift between carriers in a FSK or number of tones in a MFSK signal)
- Symbol rate
- SNR
- Time
- Stations (number of records in the stations database)

The following figure shows the workflow of the classifier:

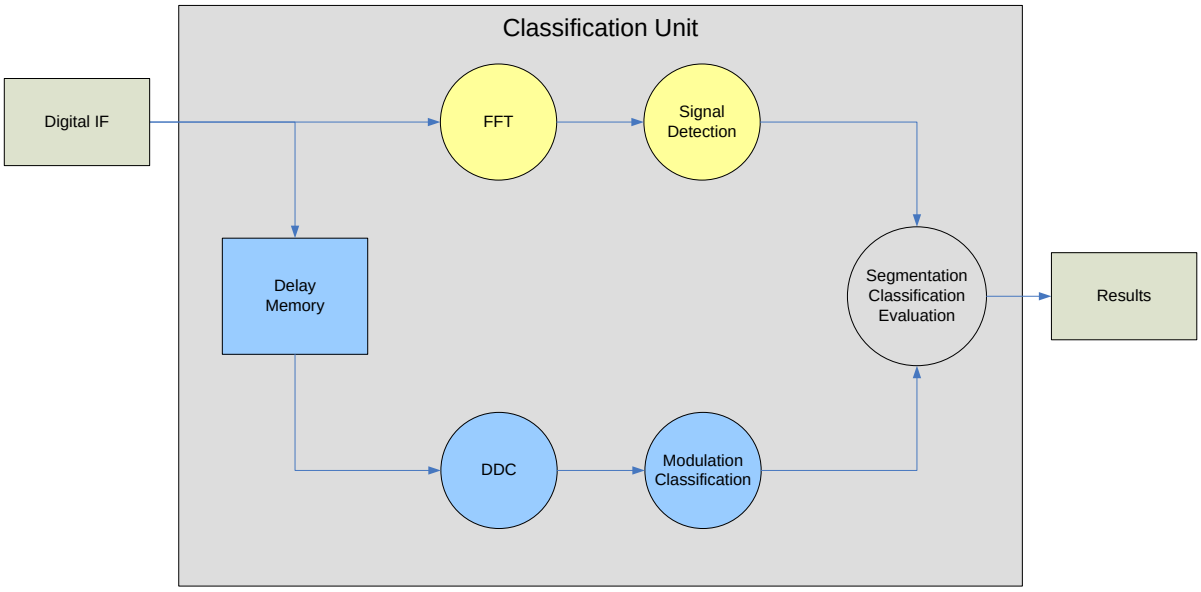


Figure 38: Classification Unit

Signal Detection and Segmentation

(Marked in yellow in *Figure 38* on page *39*)

The input signal is transformed into the spectral domain by a Fast Fourier Transformation FFT.

In the spectral domain all emissions and their parameter are determined. The following steps are executed cyclically:

- Noise level curve estimation
- Separation of noise and signal
- Center frequency and bandwidth measurement
- Energy distribution measurement
- Signal start and end time detection
- SNR measurement
- On-Air time and burst behavior measurement
- Detection of broadband interferences and elimination of errors in the result
- Time behavior for separation and combination of adjacent signals
- Rule-based merging of measured energy into emissions
- Definition of blocked-frequencies or ranges
- Automatic adaptation of detection parameters to the different frequency ranges (HF/VUHF)

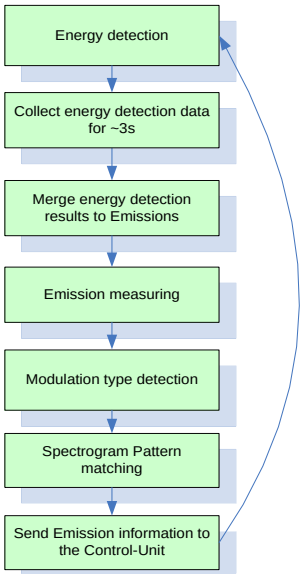


Figure 39: Steps within Classification

Classification of Modulation

(Marked in blue in *Figure 38* on page *39*)

The determination of the type of modulation is done on each signal within a narrow band.

The decision on which emissions are available and whether or not they are known is made here. If a measurement seems to be of interest the classification of modulation will be started.

Buffering

The input signal is stored in a buffer so that no part of the signal is lost during segmentation or classification.

DDC

All signals within the broadband signal are converted to narrow band signals by the software Digital Down Converter DDC. This way all signals are fragmented into smaller segments.

Classification

In this step common modulation types and modulation parameters are directly detected from the signal. Typical modems are classified by means of spectral pattern correlation. Additionally un-modulated carriers and sweepers are detected.

Technical Parameters

Classification specifications see “Classifier” on page 82.

Classifier Results

A typical result window is shown in the following figure:

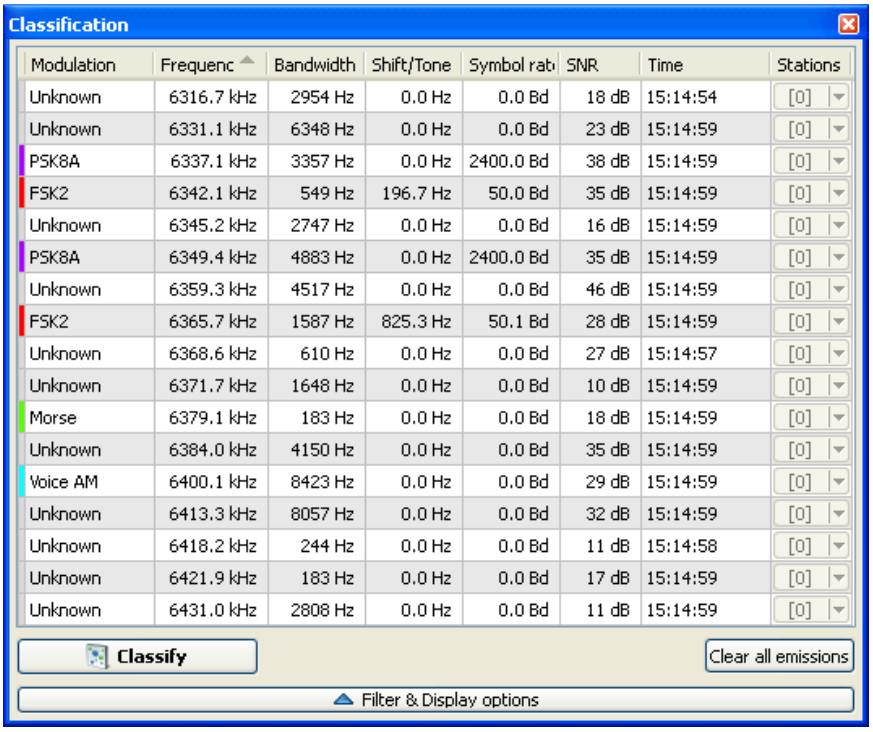


Figure 40: Classifier Result

The classifier is started with a click on the button <**Classify**>**.**

During classification the classifier is drawing a rectangle onto the signal in the spectrogram. The length of the rectangle is an indicator for the time which has been used for classification. The width is equal to the bandwidth which has been classified. The color of the rectangle is an identification which signal has been recognized. The type of classified modulation is written to each rectangle.

The color is defined in the display and filter options of the classifier. They can be set to any color available on the computer.

The spectrogram with these rectangles is shown in the next figure.

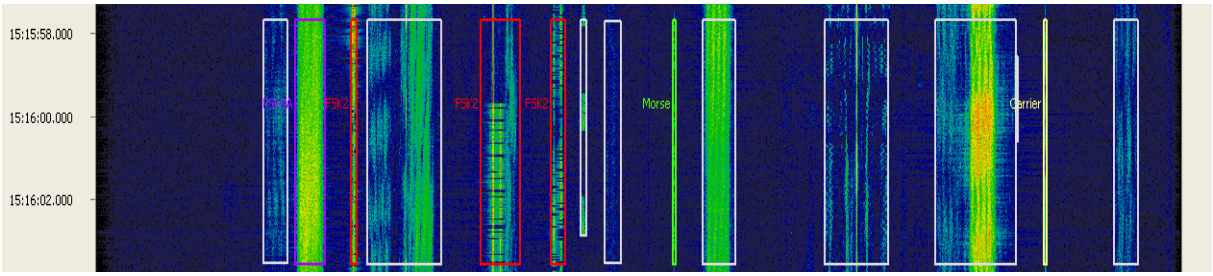


Figure 41: Classifier Result Display in Spectrogram

With the button **Clear all emissions** the results in the classifier list and in the spectrogram are deleted.

Tuning the Receiver from the Classifier Result

The results in the list can be used to tune a channel to the frequency of a classification result. With a left click and hold the record can be dragged and be released to a channel window. The center frequency of the channel spectrum or spectrogram will be set to the selected frequency.

A right click will also open a context menu which provides all channels available in the software. From this list one channel can be selected. The center frequency of the selected channel spectrum or spectrogram will be set to the selected frequency.

Filter and Display Options

There are several options available which handle the work with the classifier.

- **Show emission in spectrogram,** classification will be started automatically when the receiver is tuned to a new center frequency.
- **Pause spectrogram after each classification,** the spectrogram display will be stopped after the classification is finished.
- **Classify a new frequency range automatically,** the classification should start automatically if the receiver center frequency is changed.
- **Clear emissions before each new classification,** the result list is cleared before a new classification is started.
- **Display only emissions from the visible frequency range,** show only the results from frequencies visible in the spectrogram.
- **Classify automatically in time intervals, c**lassifications can be done automatically all 10s, 20s or 30s. Select No to disable this function.
- The **Line width** can be set to single, double or triple.

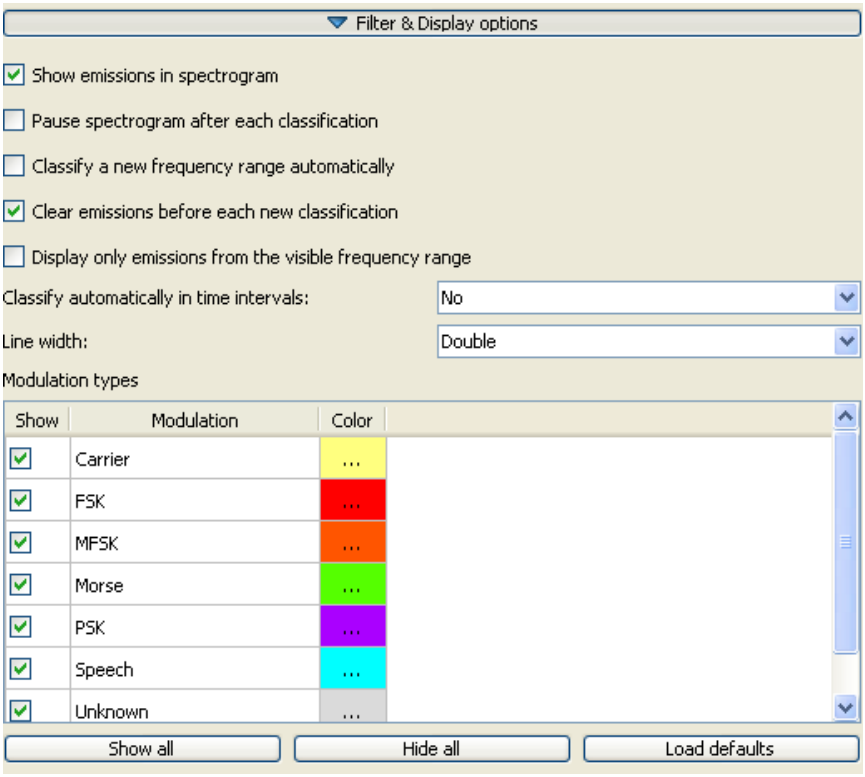


Figure 42: Classifier Options

- **Show all,** will enable all types of modulation
- **Hide all,** will disable all types of modulation.
- **Load defaults** will overwrite all color changes with the originally delivered color set.

Stations

General

go2MONITOR has an integrated stations database. This database can store information about monitored signals. An optional and actual Klingenfuss Utility and Broadcast database is available from PLATH AG for import.

The station database can be sorted by a click on the header of each column. The columns of the database and their contents are explained in the following table:

Column	Description
Frequency	The frequency of the dataset
Station	The name of the station or the usage for a frequency
Modulation	The used primary modulation like CW, USB, LSB, AM, FM or Digital and others
Protocol	The used protocol or name of the waveform
Bandwidth	The bandwidth of the signal
Symbol rate	The symbol rate of the protocol
Callsign	The call sign of the station
Country (ITU)	The country code according ITU
Schedule	The used time schedule when the station is on air.
Comments	Comment related to the station
Date	Date when the station has been stored in the database
UID	ID of the dataset

Table 8: Elements of Station List

In the **Stations** window, the comment of a selected record is displayed.

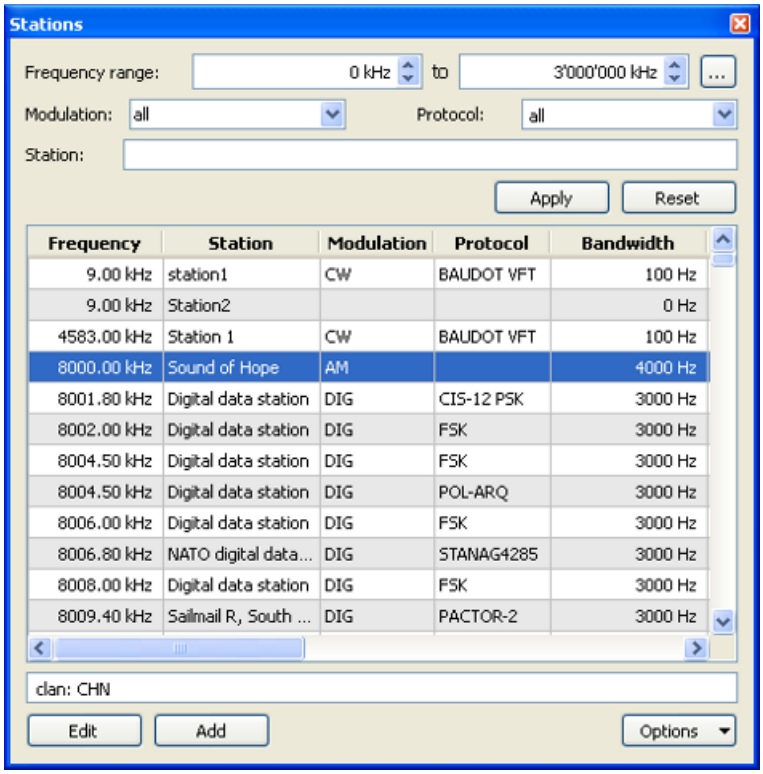


Figure 43: Station List

It is possible to select only a subset of datasets by performing a query to the list. The values are entered into the fields in the upper part of the window. These fields are described in the following table:

Item		Description
Frequency range		Enter a value into the from and to field
	Current frequency range	Only frequencies from the selected receiver bandwidth are selected
	VLF (3-30 kHz)	Frequencies in the VLF range from 3 kHz to 30 kHz are selected
	LF (30-300 kHz)	Frequencies in the LF range from 30 kHz to 300 kHz are selected
	MF (300-3000 kHz)	Frequencies in the LF range from 300 kHz to 3000 kHz are selected
	HF (3-30 kHz)	Frequencies in the HF range from 3 MHz to 30 MHz are selected
	VHF (30-300 MHz)	Frequencies in the VHF range from 30 MHz to 300 MHz are selected
	UHF (300-3000 MHz)	Frequencies in the UHF range from 300 MHz to 3000 MHz are selected
Modulation		The field Modulation provides a selection of all used modulations in the database. By choosing a modulation only the selected one will be displayed in the list
Protocol		The field Protocol provides a selection of all used protocols in the database. By choosing a protocol only the selected one will be displayed in the list
Station		In the field Station a station name or parts of a name can be entered. All datasets in the column Station containing this name or the part of the name will be shown in the list.

Table 9: Sort/Search Functions Station List

Apply will add a filter to the table according to information in the search fields. It must be pressed to update the output.

Reset will delete all search fields.

Edit Stations

Each record can be edited if new information is available. **Edit** will display the **Edit station** window. Edit is also available with the context menu available after a right-click on a station record.

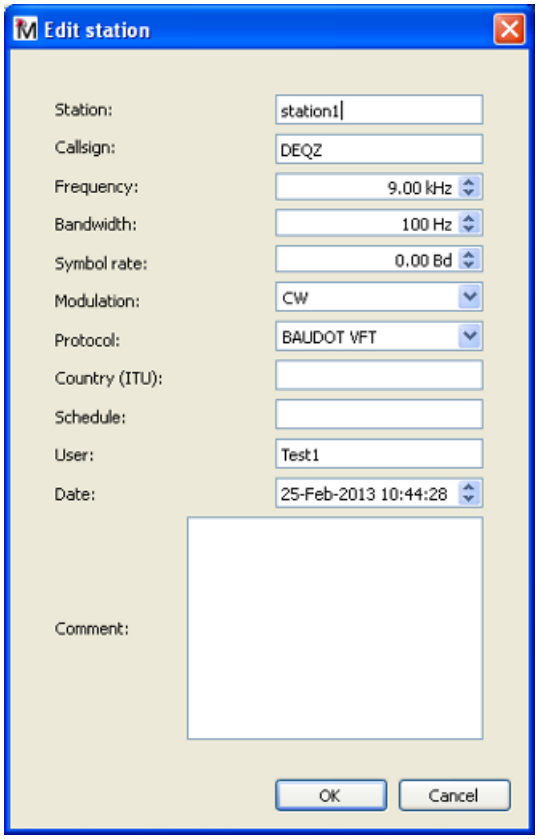


Figure 44: Edit Station

The button <**OK**> will store the new or changed information in the database and close the window. <**Cancel>** will close the window without any changes.

Add Stations

A new station can be added to the database. **Add** will display the **Add station** window.

Add is also available with the context menu available after a right-click on a station record.

You can enter the new information in each field. At least a valid frequency should be given to the new record.

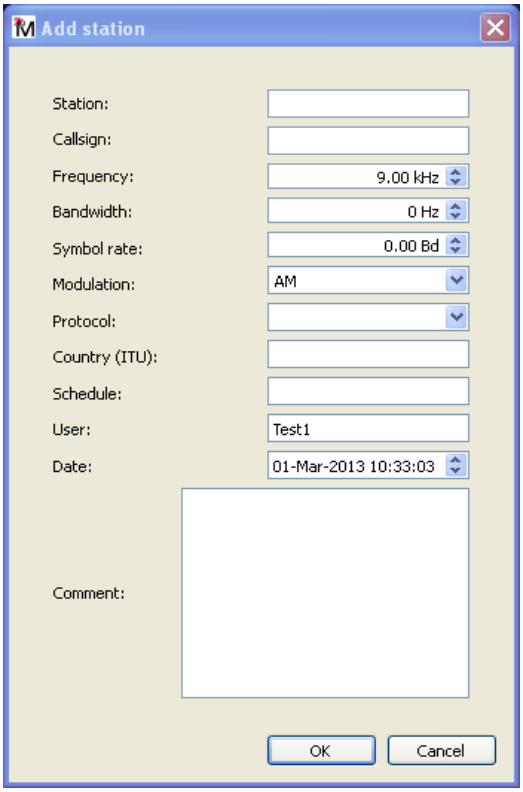


Figure 45: Add Station

The button <**OK**> will store the new information in the database and close the window. <**Cancel**> will close the window without any changes.

Database Directory

The software uses the station database available in the user directory **\go2Signals** go2MONITOR\station.db. All changes are stored in this file. If this file is not available, then the default database located in the program directory will be copied to the user directory. If no database is available in the program directory, then a new, empty database will be created in the user directory.

Options

The button <**Options**> will open a menu with additional functions.

Delete Selected

The selected datasets will be deleted, but are still available in the database.

Delete All

All datasets will be deleted, but are still available in the database.

Show only Deleted

Only deleted stations are displayed.

Import and Export of Data

If new station data are available from an external source these can be imported to the stations list. The station data have to be in a specific *csv*-file format with the ";" as separator. They are written to the file *Station.db* in the user directory.

The contents of the station list can be exported to a comma separated *csv*-file.

See "Station List CSV File" on page 78 for more details on the *csv*-file.

To refresh the screen after an import, move the slider on the right.

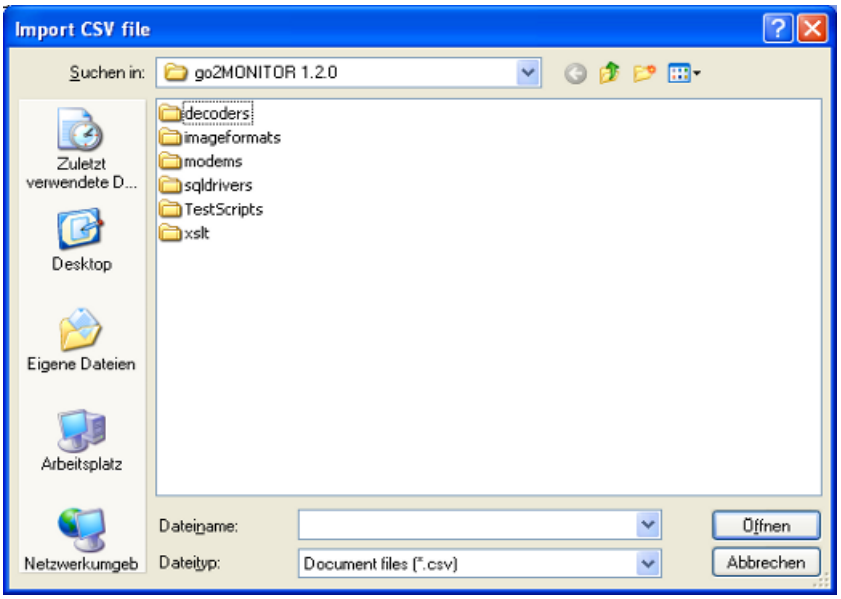


Figure 46: Import Station Data

Tuning the Receiver directly from the List

The datasets in the list can be used to tune a channel to the frequency of a station. Therefore the selection should contain only the stations within the receiver bandwidth. With a left click and hold the dataset can be dragged and be released to the channel window. The center frequency of the channel spectrum or spectrogram will be set to the selected frequency.

Channel Window

General

The channel window makes it possible to process a single signal, this includes the classification, recognition and decoding. The signal can be selected in the spectrogram of the main screen by a double click or with the context menu (right–click). It will be transferred to the next free channel. If there is only one channel available this will be selected.

Drag-and-drop of classifier results onto channel windows is also possible.

The number of channels depends on the software version of go2MONITOR.

The channel window provides four different working modes:

- Classification
- Decoding
- Recognition + Decoding
- Classification + Recognition + Decoding

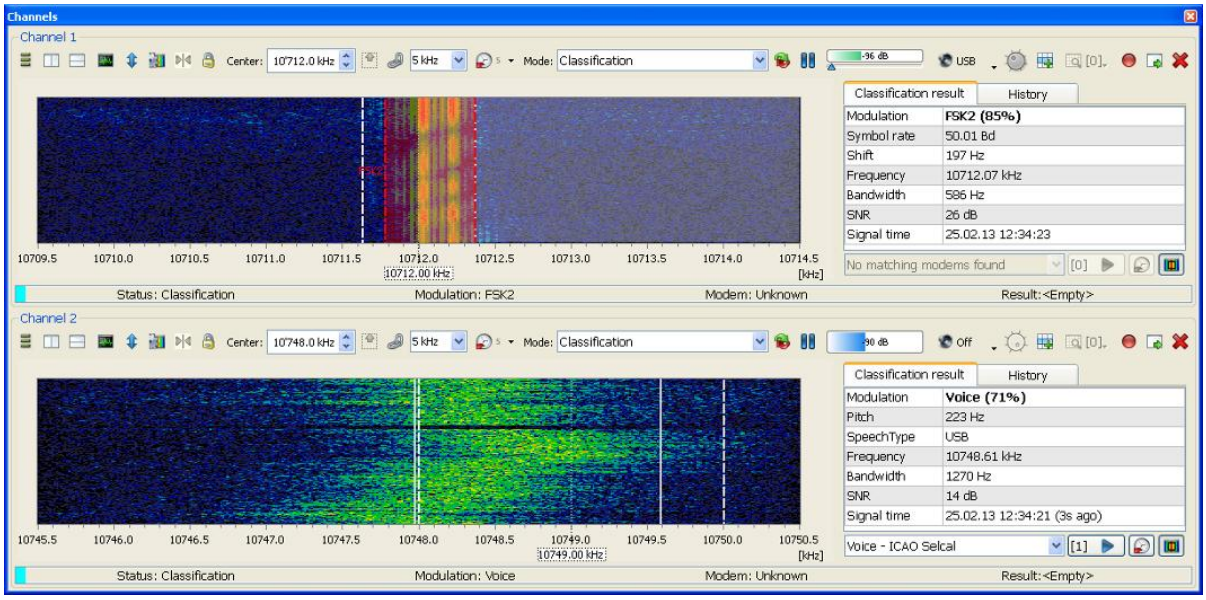


Figure 47: Channel Window

Delays

go2MONITOR provides the option to use a delay between selecting a signal in the main view until it will be displayed in the channel window. This delay can be set by the drop down box  . Possible delay times are 5s, 10s and 15s. Clicking on the left part of the icon enables or disables the delay.

Working with Multiple Channels

Depending on the license go2MONITOR can display 1 to 8 channels at the same time. The following figure shows a version with four channels.

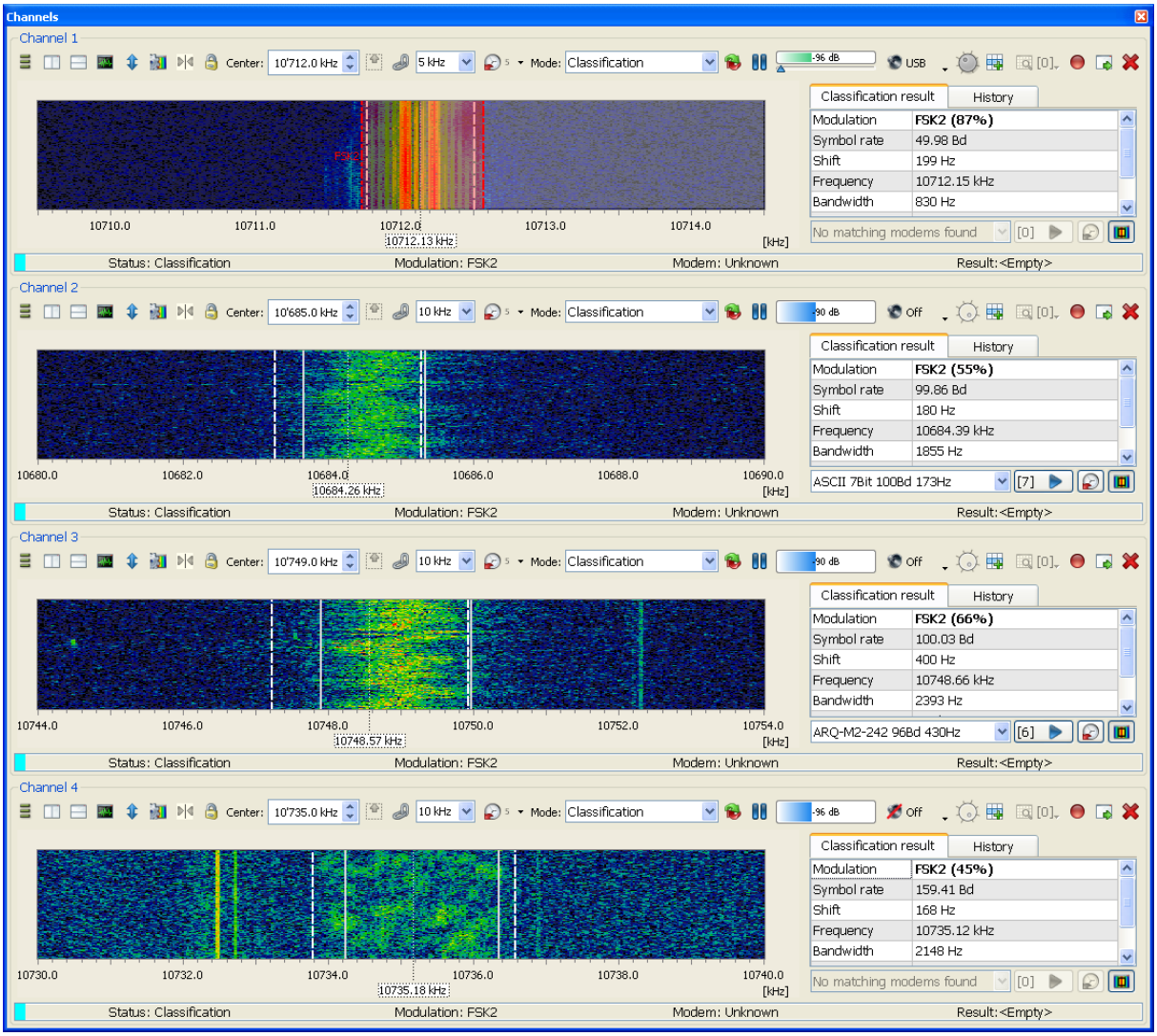


Figure 48: Channel Window with Four Channels

Predefined Window Styles

In the channel view different display types can be applied. Each style changes the arrangement of window components. The figure below displays each channel in a different display style (from top to bottom: minimal view, horizontal view, vertical view).

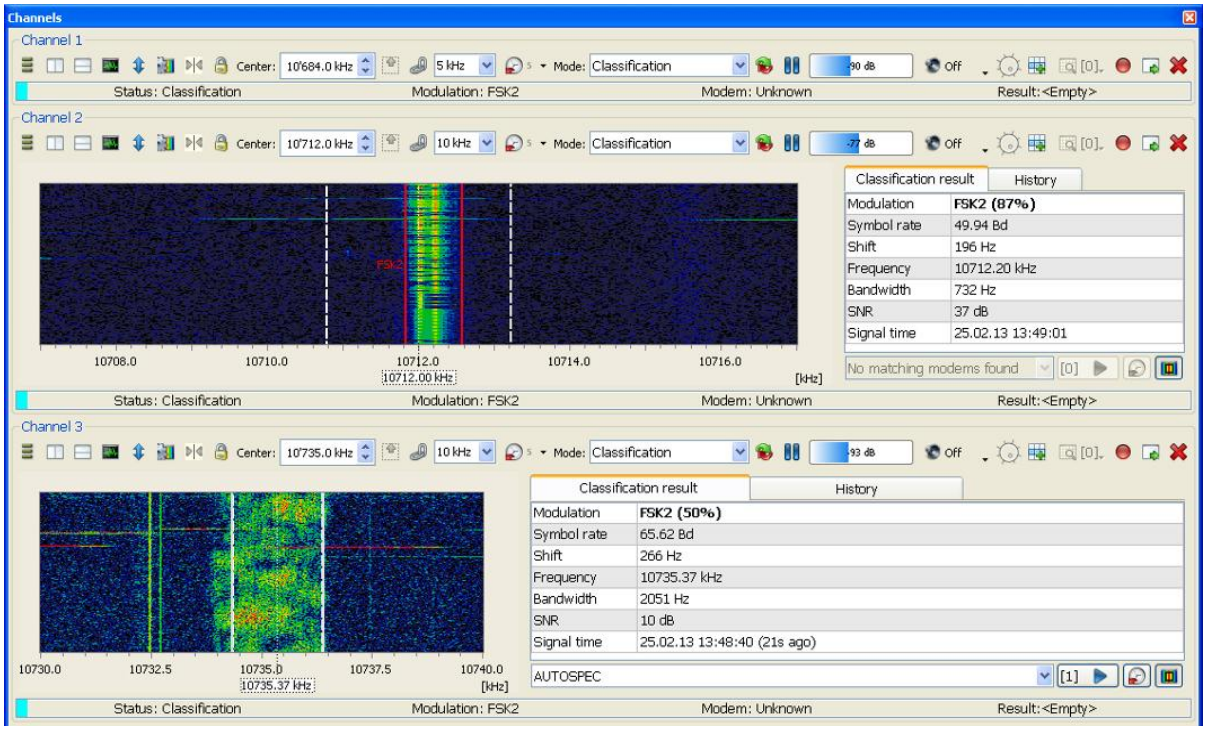


Figure 49: Predefined Window Styles

Minimal View

When channels are displayed in minimal view style, only the toolbar to control the channels is displayed. All other window components are hidden.

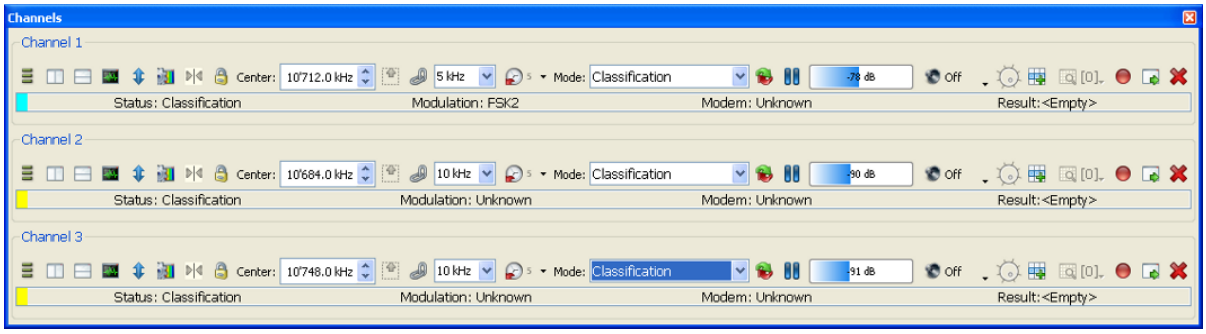


Figure 50: Channels Displayed in Minimal View Style

Horizontal View

If a channel view is displayed in horizontal display style all components are displayed in one horizontal line. Tables might be displayed with a slide bar at the bottom if the table is too wide.

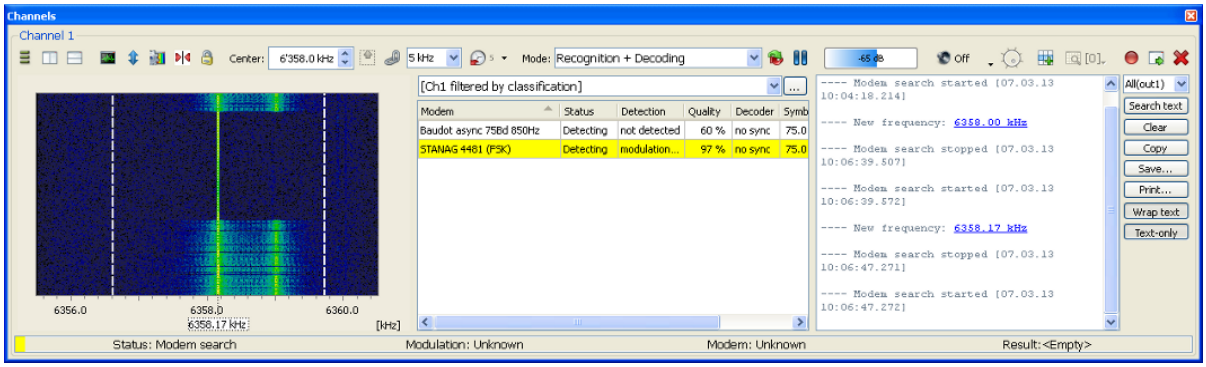


Figure 51: Channel Displayed in Horizontal View Style

Vertical View

The channel view displayed in vertical style shows all columns of all tables and might need two rows. No slide bars below tables will be used, all table columns are displayed.

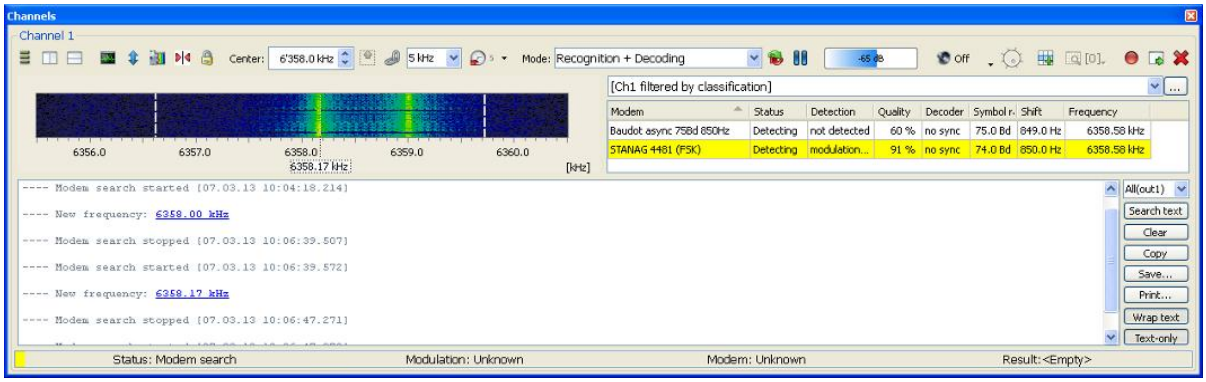
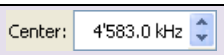
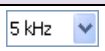
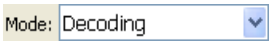


Figure 52: Channel Displayed in Vertical View Style

Channel Window Toolbar

Button	Description
	Views (See also chapter 0 Predefined Window Styles)
	Switch
	Auto range
	Spectrogram Settings (See also chapter 0 Spectrogram Settings)
	Exact Frequency
	Lock Signal
	Center Frequency
	Set channel in the current frequency range
	Set receiver to follow …
	Channel Bandwidth:
	Delays (see also chapter Delays).
	Mode selection
	Restart Processing
	Pause Processing

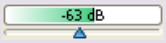
Button	Description
	Audio Squelch
	Demodulator
	Volume
	Add to Station List (see also chapter Add Stations)
	Matching Station
	Start Recorder
	Detach/Attach Channel

Table 10: Channel Window Toolbar

Spectrogram Settings

Parameters

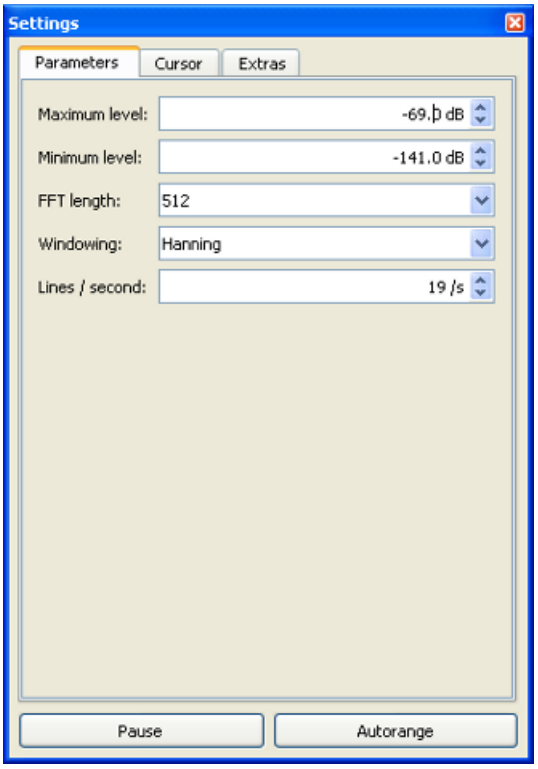


Figure 53: Spectrogram Settings Channels - Parameters

In this window the parameters for the spectrogram can be set up and it provides additional functions.

Parameter	Description
Maximum level	Defines the maximum level of the display.
Minimum level	Defines the minimum level of the display.
FFT length	Number of values of frequency in which the signal is displayed. To get a higher resolution of the displayed frequency range, the FFT length should be increased.
Windowing	The FFT algorithm is used for the calculation of the spectrum. This algorithm indicates inaccuracies in the amplitude (attenuation) as well as in the bandwidth (expansion) of a signal due to the finite signal probe. These inaccuracies can be reduced using different windowing.

Parameter	Description
Lines/second	Number of spectrums that can be calculated and displayed within one second. This parameter sets the time resolution for the spectrogram which is directly related to the scroll speed of the display.
Pause	In Pause, the display is stopped (not the signal processing). A change of parameters is possible for a more detailed analysis of the current signal.
Auto range	Automatic setting of the displayed range to view the total amplitude.

Table 11: Spectrogram Settings Channels – Parameter

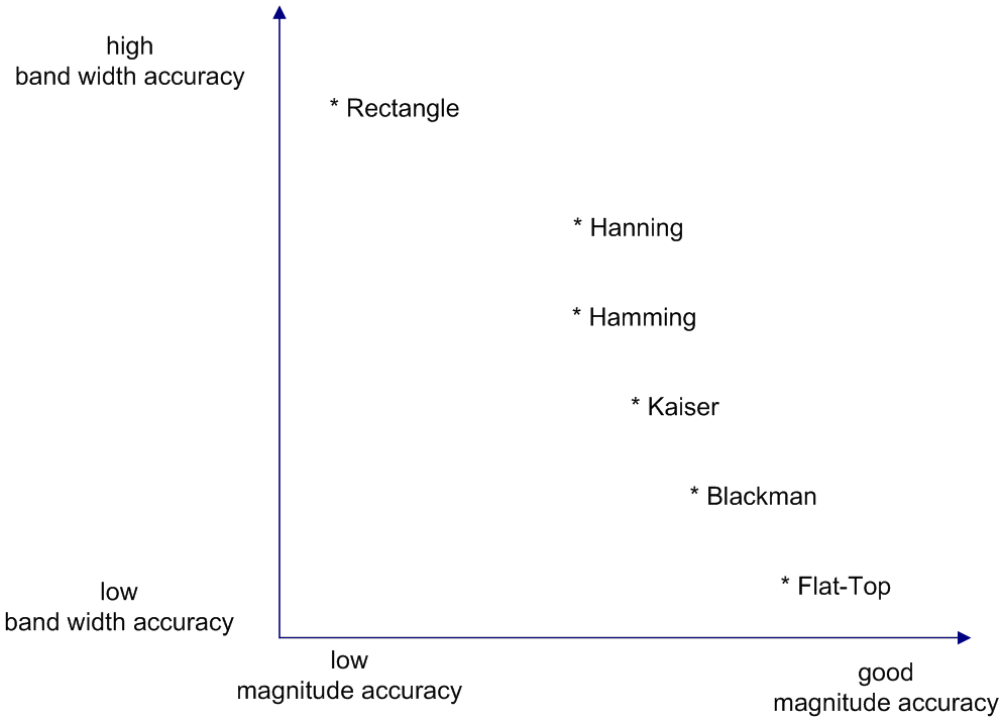


Figure 54: Windowing

Cursor

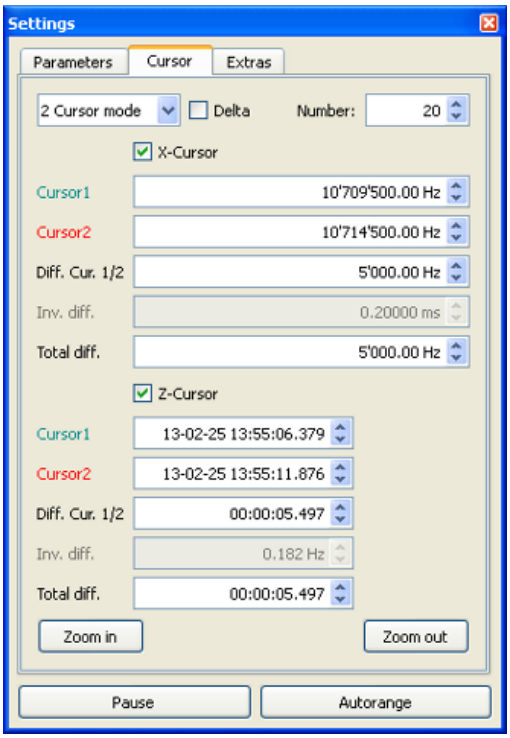


Figure 55: Spectrogram Settings Channels - Cursors

In this window the cursor functions can be set up. It provides also the function to zoom in and out to the display.

Cursor		Description
X-Cursor		The cursors are activated/deactivated in X-direction. They are used to measure frequencies in Hz.
	Cursor1	Frequency for cursor 1
	Cursor2	Frequency for cursor 2
	. 1/2	Frequency distance between cursor1 and cursor2
	Inv. diff.	Inverted difference is a function for direct time readout according to the formula 1 / [value in box. 1/2]
	Total diff.	Frequency distance between the first and last cursor in 2 cursor mode, harmonic or mirror mode.
Z-Cursor		The cursors are activated/deactivated in Z-direction. They are used to measure values of time.
	Cursor1	Time of cursor 1
	Cursor2	Time of cursor 1
	. 1/2	Time difference between cursor 1 and 2
	Inv. diff.	Inverted difference is a function for direct frequency readout according to the formula 1 / [value in box. 1/2]
	Total diff.	Time distance between the first and last cursor in 2 cursor mode, harmonic or mirror mode.
Cursor Mode		
	2 Cursor mode	For measuring tasks two cursors are displayed at the same time.
	Harmonic	With this button a specific number of cursors defined by the spin box Number at

Cursor		Description
		equidistant intervals in the area delimited by cursor1 and cursor2 are displayed. This mode makes it i.e. easy to measure the frequency distance for multi frequency signals like MFSK.
	Mirrored	With this button a specific number of cursors defined by the spin box Number at equidistant intervals on the left and right side of cursor1 are displayed. The number off cursors should be odd.
	Center	
Delta		
Number		With this spin box the number of cursors is selected to be displayed in Harmonic or Mirror mode.
Zoom in		With enabled cursors, the button Zoom in permits to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by a factor defined by the Relative factor in the Spectrogram settings of the total bandwidth around the center frequency. Additionally, a rectangle can be drawn in the display window and you zoom into this section graphically.
Zoom out		Each time the button Zoom Out is activated the Zoom in function is reversed.
Pause		In Pause, the display is stopped (not the signal processing). A change of parameters is possible for a more detailed analysis of the current signal.
Auto range		Automatic setting of the displayed range to view the total amplitude.

Table 12: Spectrogram Settings Channels - Cursors

Appearance of Cursors

When operating with channels there are different appearances of cursors in the spectrogram. Whenever the channel is selected you will get two different line combinations.

- One display displays two wide and a weak dotted line. These are the search range and the center frequency for the signal. The weak dotted line can be moved within the spectrogram to select the center frequency of the signal. Both wide dashed d lines can also be moved towards the center line or away from it to set range that used to find the correct center frequency for decoding.
- Another display displays two fixed grey lines which are indicating the bandwidth of the signal as determined by the classifier. The distance of these lines will change as the result of the classifier depends on the signal quality.

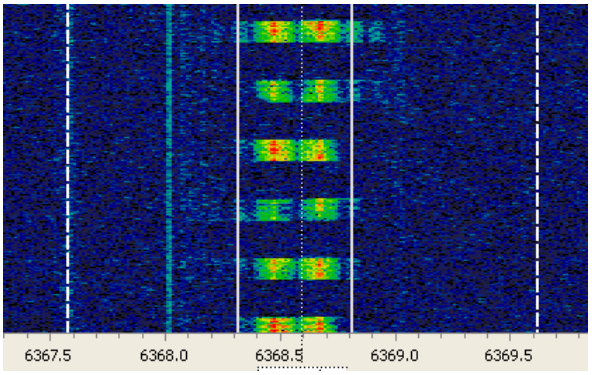


Figure 56: Channel Cursor

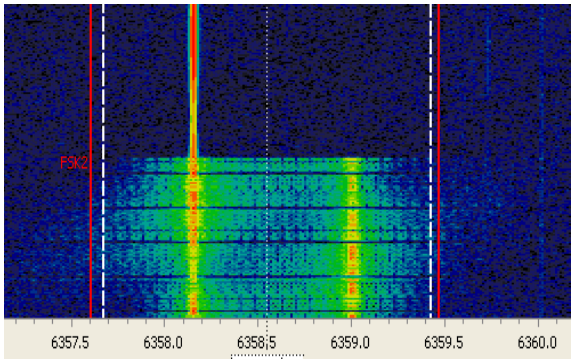


Figure 57: Channel Cursor - Classification with Result

When the classification process has finished with a result the color of line will change according to the colors defined in the classifier window. The name of the detected mode is written to these lines.

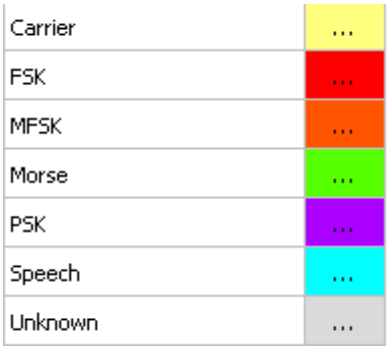


Figure 58: Colors Classification Results

When selecting one of the demodulators like USB or AM the bandwidth of this demodulator will be displayed in the channel view as a white transparent overlay.

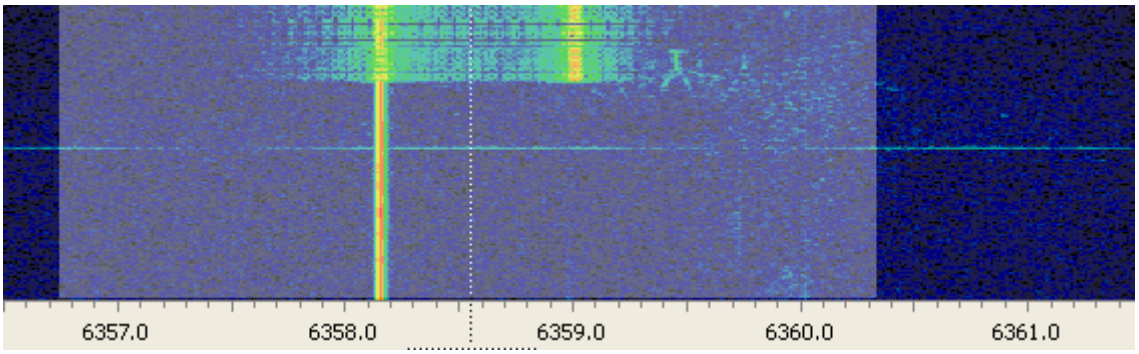


Figure 59: Channel View With Demodulator Bandwidth

Extras

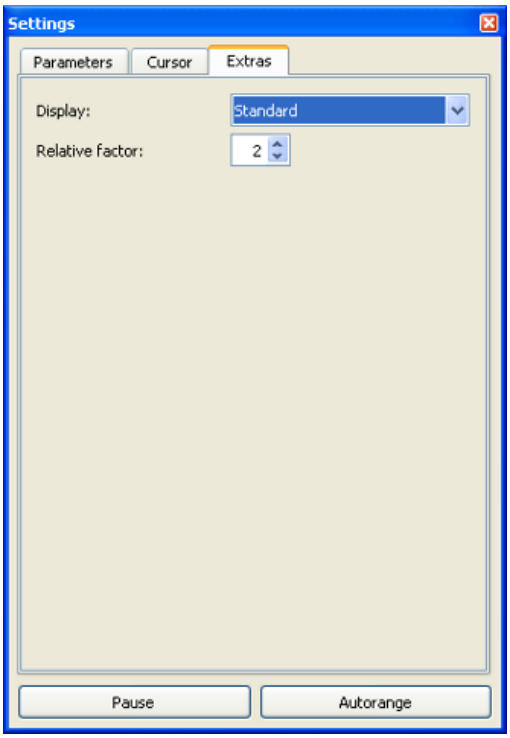


Figure 60: Spectrogram Settings Channels – Extras

In this window different display types and the relative factor can be adjusted. The display can be paused and be arranged to the signal levels.

Item		Description
Display		
	Inverse	This item activates the invers color display.
	Standard	This item activates the standard color display.
	Monochrome	This item activates the monochrome color display.
Relative factor		The relative factor is used for the zoom process to determine the zoom factor.
Pause		In Pause, the display is stopped (not the signal processing). A change of parameters is possible for a more detailed analysis of the current signal.
Auto range		Automatic setting of the displayed range to view the total amplitude.

Table 13: Spectrogram Settings Channel – Extras

Frequency Control and Bandwidth

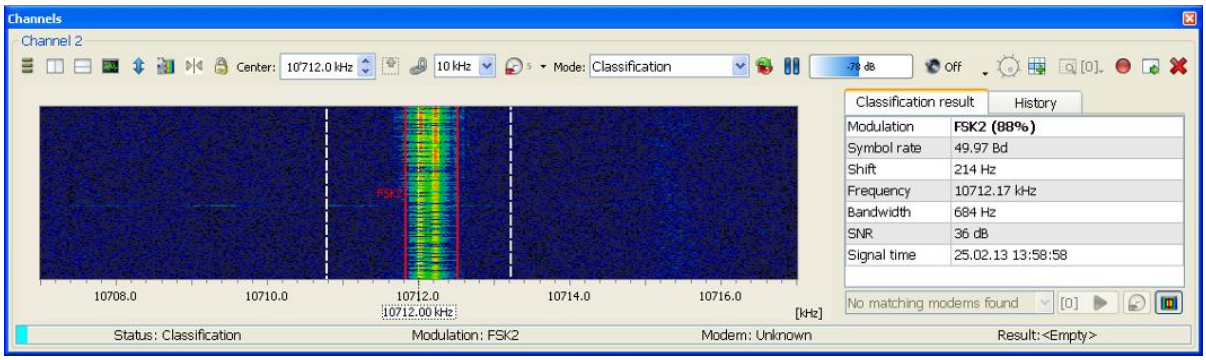


Figure 61: Adjusting Frequencies and Display Bandwidth

If necessary, the center frequency can be adjusted with the mouse by moving the center line of the signal or by entering a new frequency into the **Center** field. It is also possible to place the mouse cursor on the right side of a digit in the center field and to change the frequency with the mouse wheel.

The total bandwidth of the channel spectrogram can be adjusted with the bandwidth field.

It is possible to set the bandwidth to 2 kHz, 5 kHz, 10 kHz, 15 kHz, 20 kHz, 30 kHz and 50 kHz. This bandwidth will also be indicated at the signal in the main spectrogram.

It is possible to listen to the signal in a channel window. The drop-down-box will open a context menu where the following demodulators can be selected:

Demodulator	Description
USB	Upper side band
LSB	Lower side band
AM	Amplitude modulation
FM	Frequency modulation
Digital	1.8 kHz offset from the center frequency , bandwidth 3.6 kHz
CW	Continuous wave or morse with an offset of 800 Hz from the center frequency
Off	No audio output
Output channel	Audio output to the left, right or to both audio channels

Table 14: Channel Window - Demodulators

The bandwidth of each modulator will be displayed as an overlay in the channel spectrogram.

Result Window

When a production of output is started, then the decoded text this will be displayed in the result window. The most recent decoded text will also be displayed in the right part of the status bar. This has the advantage that in case of a minimized channel window the output of a decoder still can be monitored.

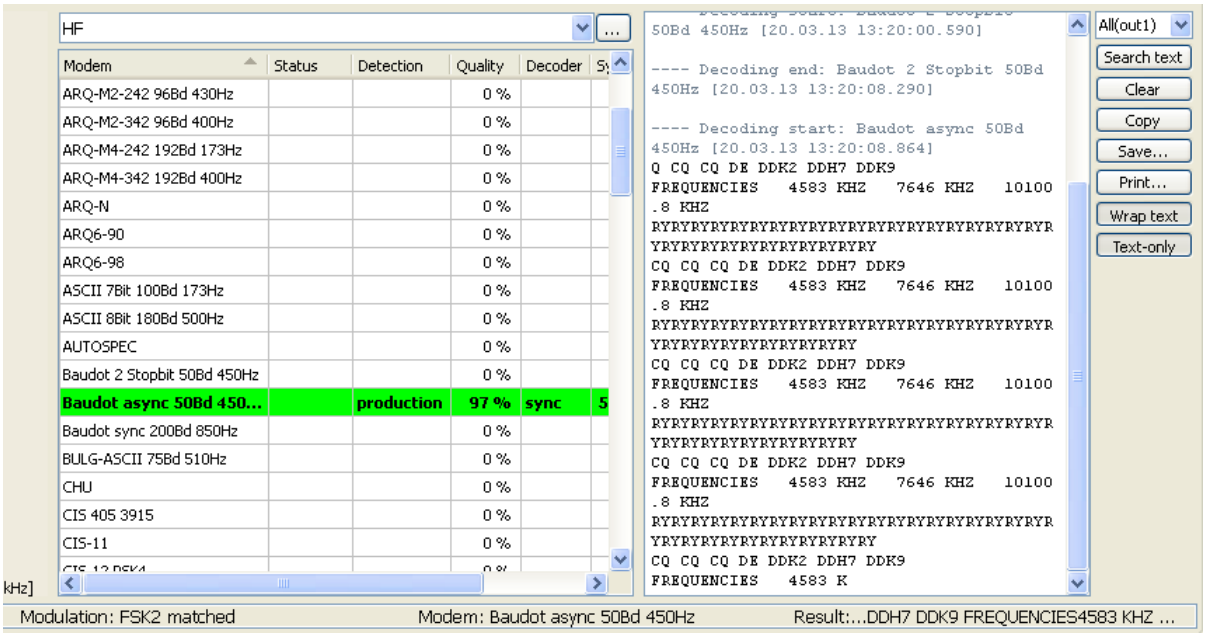


Figure 62: Result Window

Result Window Toolbar

Button	Description
All(out1) All(out1) All(out1-4) Files Text Unformatted	Output format selection XSLT setup
Search text	Search text 
Clear	Clear
Copy	Copy
Save...	Save Decoder Results (see also chapter Save Decoder Result)
Print...	Print: (see also chapter Print)
Wrap text	Wrap text (see also chapter Wrap text)
Text-only	Text only (see also chapter Text Only)

Table 15: Result Window Functions

Save Decoder Result

Results displayed in the decoder result window can be saved. Use the button <**Save**> to open an explorer window to define name and place of the file.

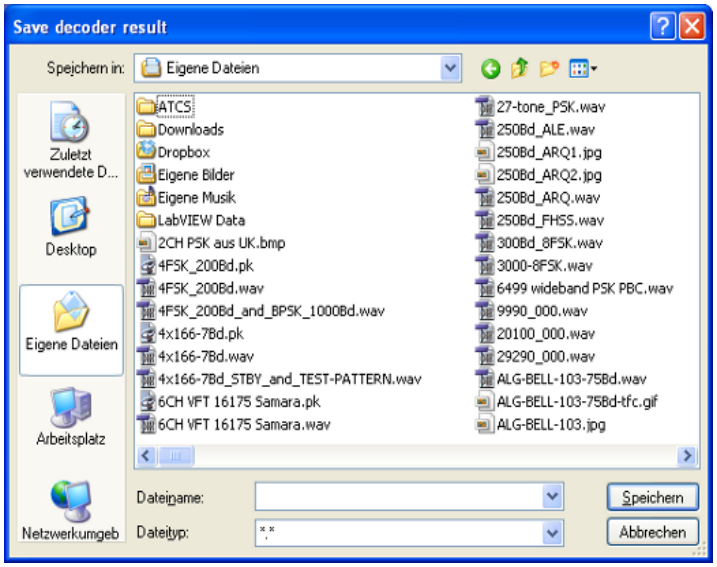


Figure 63: Explorer Dialog to Save Decoder Results

Print

Decoder results currently displayed can be printed. Use the button <**Print**> to open the print dialog for your workstation. Define printer settings as usual.

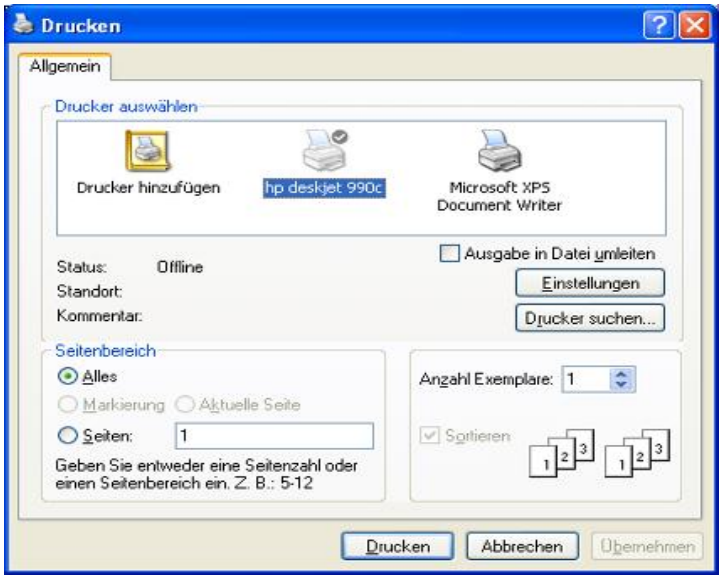


Figure 64: Print Dialog

Wrap text

This function changes the line break of the text. If the function is active (button has grey background) data is displayed within the window without a slide bar at the bottom.

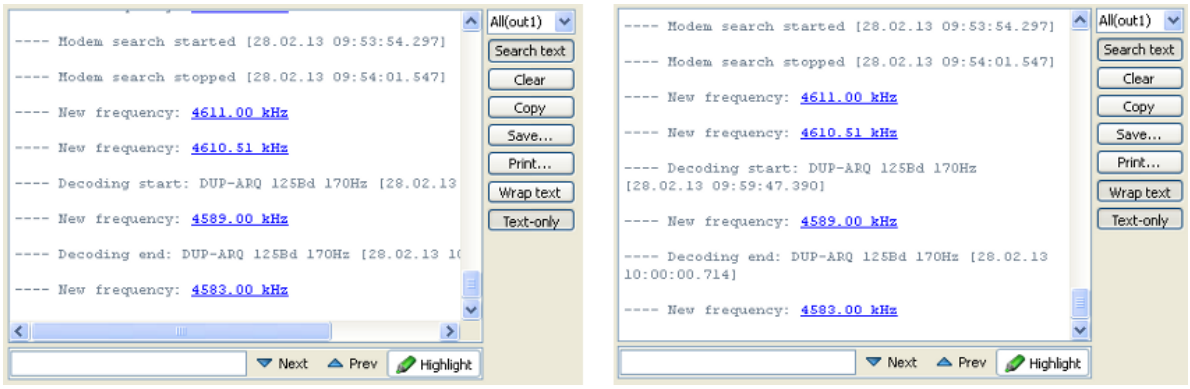


Figure 65: Decoder Results With Line Break (on the right)

Text Only

If the button <**Text only**> is activated all <new line> characters in the decoded result are interpreted as a real new line and will be replaced in the output window by a HTML line-break. For text output this selection may help reading clear text. In case of binary results the new line character may have another meaning and the replacement will cause errors in an additional processing-step.

Classification Mode

General

The classification tool takes a probe of the signal and determines the possible type of modulation.

By using the classification unit, it is possible to detect, measure and determine the modulation type for a signal in the currently available frequency range. The resulting information can be displayed in the GUI and used as an input to the further automatic or interactive processing.

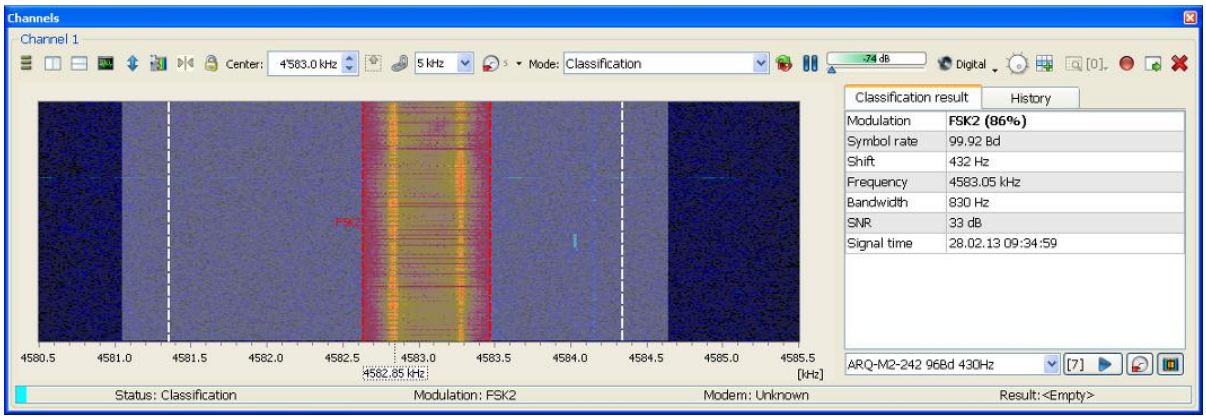


Figure 66: Classification Window with Result

Classification Results

The software measures several parameter of the signal probe. From these parameters the modulation of the signal will be determined. Additional the symbol rate is calculated. Depending on the type of modulation different parameters of the signal are displayed in the classification results.

Dynamic Modem List

According to the classification result the software will propose a selection of modems which may match the signal. This reduced list can be opened with the drop down box below the result window. All these modems are stored in a special list **[ChX filtered by classification]** which can be used further on when switching to the mode recognition or decoding.

Figure 67: Dynamic Modem List

The button on the right side of the dynamic modem list displays the number of possible modems in the list. By selecting this button the mode **Recognition + Decoding** will be opened containing the suggested modem list.

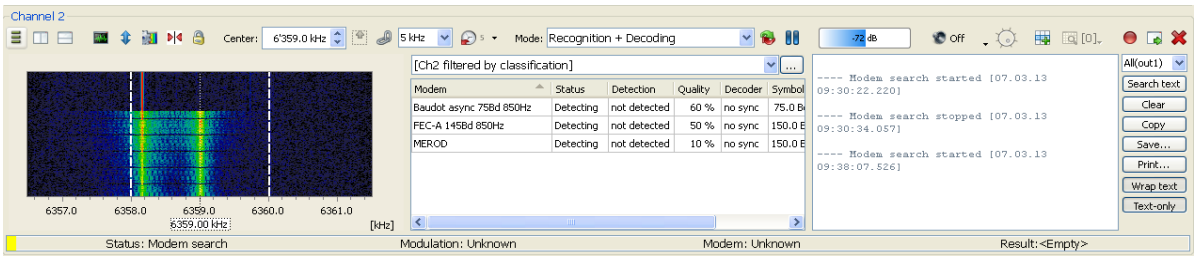


Figure 68: Recognition + Decoding with Dynamic Modem List

History

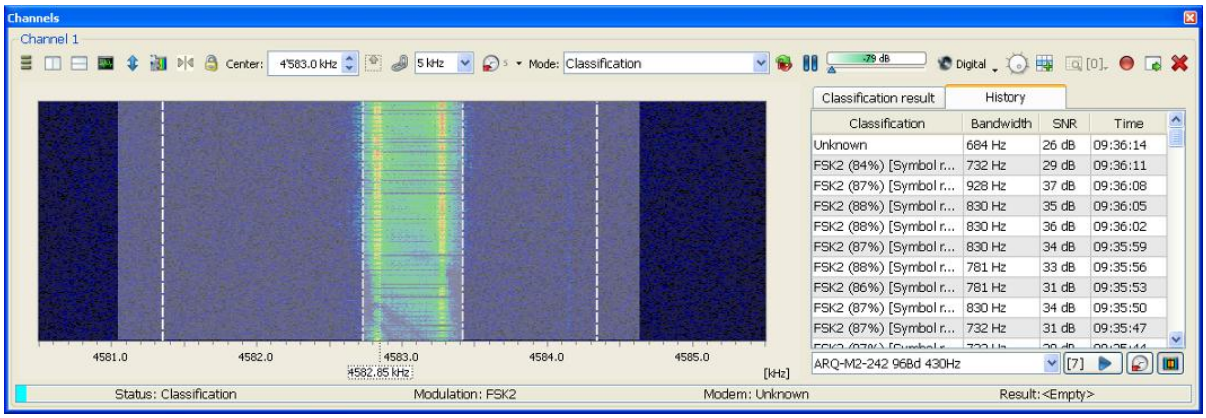


Figure 69: Channel Classification – History View

All classification results are stored in a history list which can be opened with the **History** tab. This list contains:

- Classification result with mode, probability, symbol rate and shift
- Bandwidth
- Signal to Noise Ratio SNR
- Time of recognition

The list will be cleared when the application is stopped.

Decoding Mode

General

In this mode the channel works as a decoder. From the modem list a modem can be selected. The decoded text will be displayed on the right side in the output window.

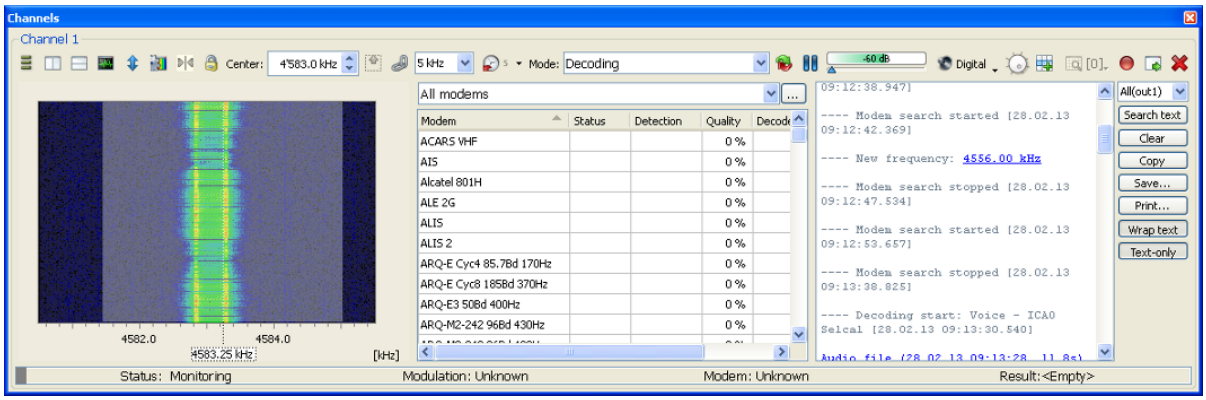


Figure 70: Channel Mode Decoding

Modem Selection

From a drop-down-list, different modem lists e.g. for HF or VHF-UHF can be selected. See “Modem List Editor” on page 24 if you have to modify or add a new modem list.

A modem is selected by a click on the modem row. The selected modem will turn to a green background color.

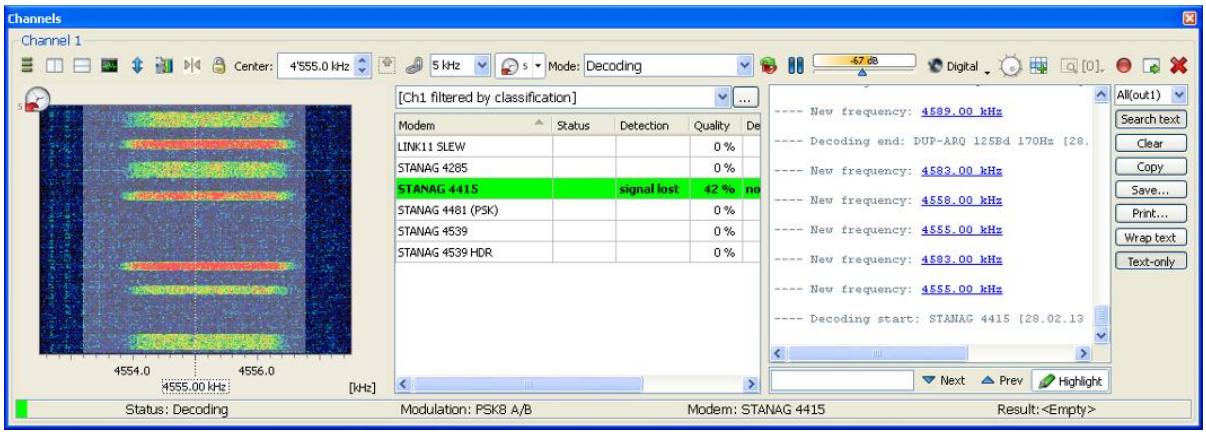


Figure 71: Decoding of Signals

Parameter	Description
Modem	The name of the modem
Status	Used during recognition: Detecting
Detection	Detection status of modem: No result: Statement on modem status not possible Signal lost: Modem was detected but is lost Production: Modem is produced Modulation tracking: The modulation type has been detected, tracking parameters Modem tracking: The modem has been detected, tracking parameters

Parameter	Description
Quality	Quality of signal in %
Decoder	Status of the decoder: No sync: Decoder not detected Identified: Decoder has detected modem characteristics in the data stream Accepted: Decoder has been detected Sync: Modem has been detected Error: Decoder runtime error
Symbol rate	Measured symbol rate in Bd
Shift	Measured shift in Hz of a FSK signal
Frequency	Receiver center frequency of the signal

Table 16: Decoder Status

Decoder List

From a drop-down-list, different modem lists, e.g. for HF or VHF-UHF, can be selected. New modem lists can be created in the **File** menu of the main screen.

Result Window

When the decoder starts with the production the result text will be written to the output window including a time stamp and a status. The most recently decoded text is additionally displayed in the status bar below the output window.

Recognition + Decoding Mode

General

A production channel uses a configurable list of decoders and checks which of these decoders matches the signal.

The signal is demodulated, decoded and the results are displayed in the result view. The decoder lists can be configured, loaded and saved.

This way the operator can define specific decoders to be used according to the monitoring task. A previous classification enhances the production. go2DECODE (go2SIGNALS product for recognition, demodulation, analysis and decoding) can be used for analysis and creation of a new decoder, which can be used in go2MONITOR.

Signals of interest can easily be added to an integrated station list. Entries in the station list can be assigned to production channels using drag & drop or the context menu.

In this operation mode the software is searching for the correct modem within a modem list. The modem list can be selected from a drop-down-list and is displayed in the table.

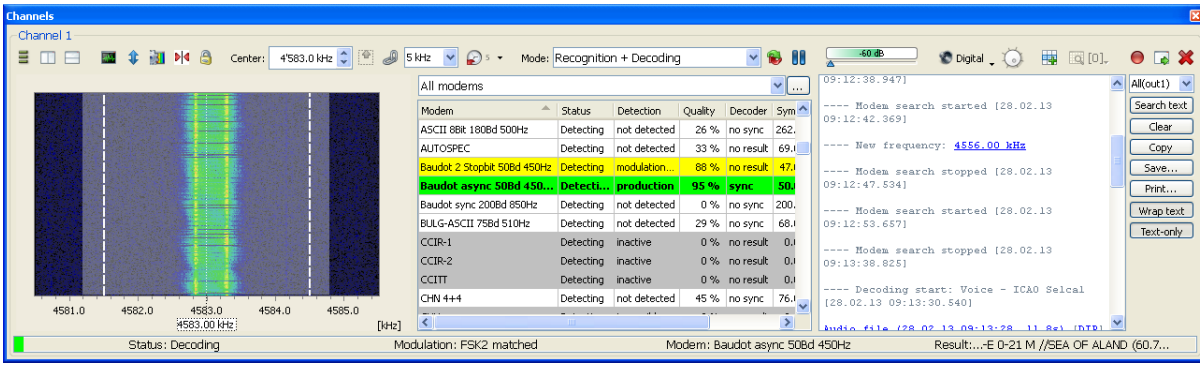


Figure 72: Recognition and Decoding of Signals

Modem Search

On starting the mode recognition and decoding, you will see that the spectrogram displays the signal in single frequencies (the figure shows a Baudot signal). In the result display, you will first see the modem search. The color of the modem in the list varies depending on the state of recognition (e.g. the Baudot line first turns yellow then green). This indicates that the signal has been recognized by the search routine. A moment later, the modem turns green and the decoded Baudot text is displayed in the pane showing the final results.

For a list of all available modems see “Decoder List” on page 84.

Classification + Recognition + Decoding Mode

In this mode the following steps are executed sequentially:

- Classification of the signal
- Building a dynamic Modem list according to parameters of the classifier results
- Start the modem recognition
- If successful, starts the decoding of the signal otherwise restart from the beginning

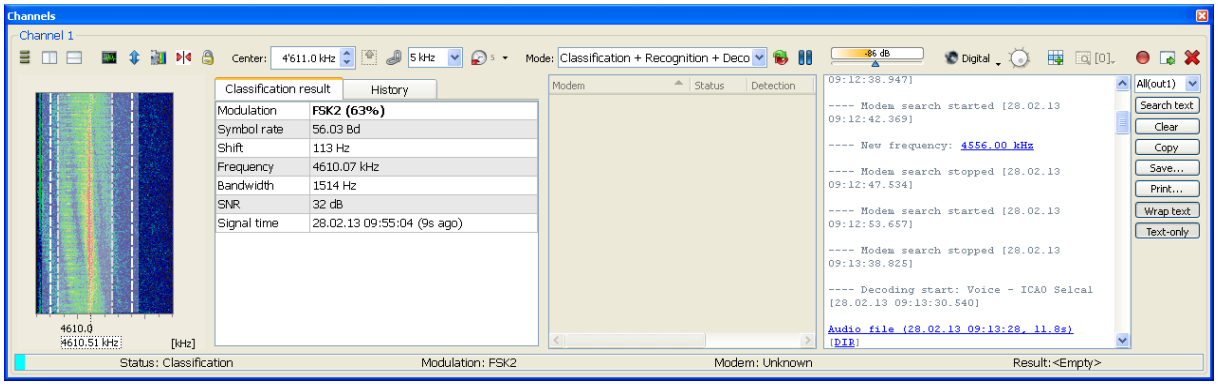


Figure 73: Classification, Recognition and Decoding of Signals

Options

Option 1: Narrowband Receiver Control 4 Channels

TBD

Option 2: Wideband Classification 20 MHz

TBD

Option 3: Automatic Monitoring and Tasking

TBD

Option 4: Multichannel Production 32 Channels

TBD

Option 5: Wideband Recording 20 MHz

TBD

Technical Reference

WAV Files

WAV Format

This subchapter describes the WAV file format extension for the storage of additional meta information which may be relevant for signals.

The standard WAV file format is a RIFF-based format containing „fmt“ and “data” chunks. For the description of these chunks and the general RIFF format, please refer to “Multimedia Programming Interface and Data Specifications 1.0”.

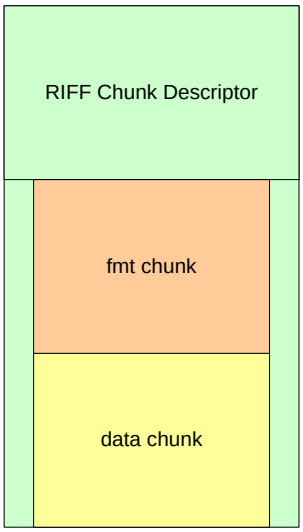


Figure 74: Standard WAV-Format

Extended WAV-Format with Custom Data

The standard WAV format includes various meta information in the “fmt” chunk describing the signal. For the use in COMINT systems, additional information regarding signal time, signal frequency etc. have to be added.

To store the information in the WAV file, an additional **Meta** chunk is added. The data in this chunk are stored in XML format. This additional chunk is ignored by standard tools which can process WAV files.

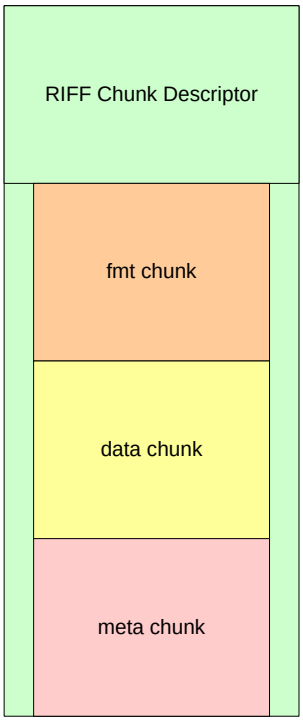


Figure 75: Extended WAV File Format

The meta data chunk has the following structure:

4	`meta`	Header-signature
4	<length>	Length of the meta-header
	XML	Meta data in XML

Table 17: Structure of the Meta Data

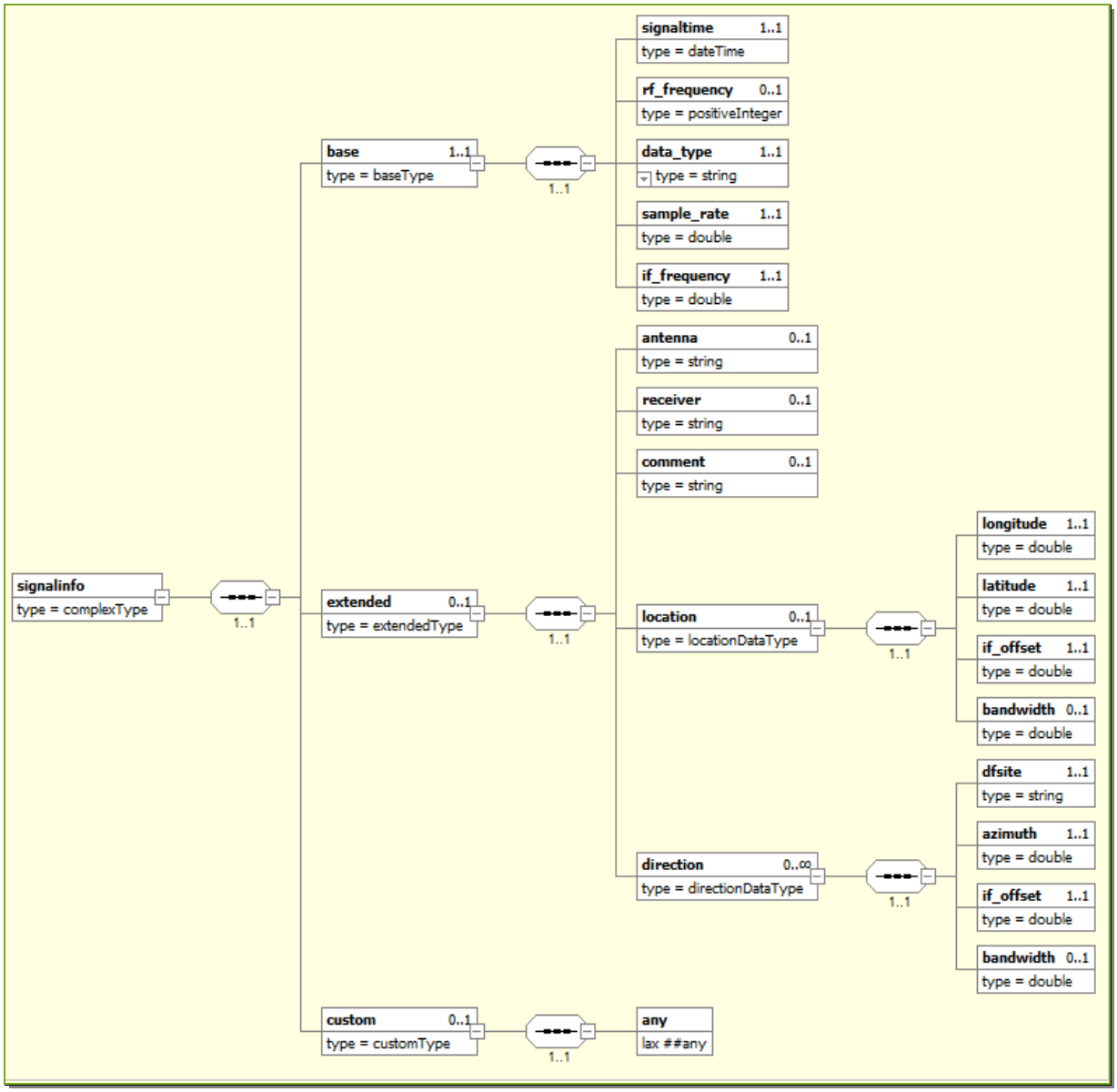


Figure 76: XML Schema

XML Schema for the content of the meta data chunk:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs=http://www.w3.org/2001/XMLSchema elementFormDefault="qualified" at-
tributeFormDefault="unqualified">
                        <xs:element name="signalinfo">
                            <xs:complexType>
                                <xs:sequence>
                                    <xs:element name="base" type="baseType"/>
                                    <xs:element   name="extended"   type="extendedType"
minOccurs="0" maxOccurs="1"/>
                                    <xs:element name="custom" type="customType" minOc-
curs="0" maxOccurs="1"/>
                                </xs:sequence>
                            </xs:complexType>
                        </xs:element>
                        <xs:complexType name="customType">
                            <xs:sequence>
                                <xs:any maxOccurs="unbounded" minOccurs="0" processCon-
tents="lax"/>
                            </xs:sequence>
                        </xs:complexType>
                        <xs:complexType name="extendedType">
                            <xs:sequence>
                                <xs:element   name="antenna"   type="xs:string"   minOc-
curs="0"/>
                                <xs:element   name="receiver"   type="xs:string"   minOc-
curs="0"/>
                                <xs:element   name="comment"   type="xs:string"   minOc-
curs="0"/>
                                <xs:element   name="location"   type="locationDataType"
minOccurs="0"/>
                                <xs:element   name="direction"   type="directionDataType"
minOccurs="0" maxOccurs="unbounded"/>
                            </xs:sequence>
                        </xs:complexType>
                        <xs:complexType name="baseType">
                            <xs:sequence>
                                <xs:element name="signaltime" type="xs:dateTime"/>
                                <xs:element                          name="rf_frequency"
type="xs:positiveInteger" minOccurs="0"/>
                                <xs:element name="data_type" default="real">
                                    <xs:simpleType>
                                        <xs:restriction base="xs:string">
                                            <xs:enumeration value="real"/>
                                            <xs:enumeration value="complex"/>
                                        </xs:restriction>
                                    </xs:simpleType>
                                </xs:element>
                                <xs:element name="sample_rate" type="xs:double"/>
                                <xs:element name="if_frequency" type="xs:double" minOc-
curs="1" default="0"/>
                            </xs:sequence>
                        </xs:complexType>
                        <xs:complexType name="locationDataType">
                            <xs:sequence>
                                <xs:element name="longitude" type="xs:double"/>
                                <xs:element name="latitude" type="xs:double"/>
                                <xs:element name="if_offset" type="xs:double"/>
```

```
                                <xs:element   name="bandwidth"   type="xs:double"   minOc-
curs="0"/>
                            </xs:sequence>
                        </xs:complexType>
                        <xs:complexType name="directionDataType">
                            <xs:sequence>
                                <xs:element name="dfsite" type="xs:string"/>
                                <xs:element name="azimuth" type="xs:double"/>
                                <xs:element name="if_offset" type="xs:double"/>
                                <xs:element   name="bandwidth"   type="xs:double"   minOc-
curs="0"/>
                            </xs:sequence>
                        </xs:complexType>
</xs:schema>
```

The length of the meta data chunk must be a multiple of 4 bytes.

The meta chunk will be added at the end of the WAV file to allow for adding the meta content without moving the data part of the WAV file.

The format of the meta chunk contains three detail levels:

- base
- extended
- custom

In the „base“ level, all elements important for the processing of the I/Q data file are stored:

Element	Description
signaltime	Time of the first sample in the file, UTC
rf_frequency	Receiver frequency in Hz
data_type	"real" or "complex" signal
sample_rate	Sampling rate (as floating point value)
if_frequency	IF-Frequency of the signal in Hz, always 0 for complex signals

Table 18: Base Level of Meta Chunks

In case of a complex (I/Q) signal, the WAV file must contain 2 channels.

In the **extended** level, additional signal are stored:

Element	Description
antenna	Antenna description
receiver	Receiver description
comment	Free comment
location	Location information
location/longitude	Longitude (-180° … +180°)
location/latitude	Latitude (-90° … +90°)
location/if_offset	Offset relative to if_frequency, used for the location info
location/bandwith	Bandwidth around if_offset frequency, used for the location info
direction	One or multiple directions
direction/dfsite	Direction finder name
direction/azimuth	Direction azimuth (0-360°)
direction/if_offset	Offset relative to if_frequency, used for the direction info
direction/bandwith	Bandwidth around if_offset frequency, used for the direction info

Table 19: Extended Level of Meta Chunks

The **custom** level contains any further user-defined fields.

This is an example of the valid XML meta chunk content:

```
<?xml version="1.0" encoding="utf-8"?>
<signalinfo xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:noNamespaceSchemaLocation="signalinfo.xsd">
  <base>
    <signaltime>2009-02-01T05:56:45.234Z</signaltime>
    <rf_frequency>6075000</rf_frequency>
    <data_type>real</data_type>
    <sample_rate>20000</sample_rate>
    <if_frequency>12500</if_frequency>
  </base>
  <extended>
    <antenna>Antenne 1</antenna>
    <receiver>EM010</receiver>
  </extended>
</signalinfo>
```

Tools

wavetxt.exe

The wavetxt application serves to provide the additional information required for the signal processing software if they are not contained in the wav file or if they are wrong. This additional txt-file can be generated with the application wavetxt.exe or be setup manually and must be stored together with the *.wav* file in the same directory.

If you have a *test.wav* file then the associated txt-file is *test.txt*!

The structure of the txt-file is:

```
                                        //                                  Comments
0.0                                  // Signal-Number, File-Number (not required)
COMPLEX                           // COMPLEX or REAL signal
1                                       // Number of channels          (not  required,
1)
10250                             // Absolute frequency  in Hz      (not required, -1)
48000.00000                    // Sample rate (Hz) of the wav file  (can  be  modified  to
correct errors)
3631 38282000 0           // Preprocessing parameters       (not required)
```

The txt-file can be automatically generated with the application wavetxt.exe. The tool is normally started from the command line or from a batch file.

Syntax:

wavetxt [-cx|-re] [f=<frequency>] <input wave filename>

Meaning:

-cx, complex

-re, real

f= x, absolute receiver center frequency (required if the application should display the true signal frequency

Example:

wavetxt –cx f=10250 test.wav (will produce the structure above)

Attention:	Depending on the package the Visual Studio Redistributable Package vcredist_x86.exe or/and Qt-DLLs must be available in the same directory!

The sample rate needs not to be specified, as the value from the wav file will be used. Later you can modify the value to correct errors!

bin, ver, txt and cmf Modem Description Files

ver files

A specific modem is characterized by the parameters which are stored in a XML-file with the extension *ver*.

The *ver*-file holds a large number of parameters. Only a subset of them is required for a given modem, the spare ones are ignored.

ver-files are located in the modem directory located in the user (highest priority) or the program directory.

ver-files can either be generated/modified with a text or XML editor, or with an application like by go2DECODE.

The basic structure of a *ver*-file is:

```
<?xml version="1.0" encoding="utf-8" ?>
<Modem version="1.0">
  <tag>value</tag>
  <tag>value</tag>
  :
  <tag>value</tag>
</Modem>
```

Next follows an example, it is the *ver*-file for the Baudot modem with 50 Bd and 450 Hz shift.

It is identified by its name :	<Name>Baudot async 50Bd 450Hz</Name>
The Baud-rate is 50 Bd:	<BaudRate>50</BaudRate>
The Baud-rate tolerance is 5 Bd:	<BaudRateTolerance>5</BaudRateTolerance>
The shift is 450 Hz :	<Shift>450</Shift>
The shift tolerance is 10 Hz :	<ShiftTolerance>10</ShiftTolerance>
The decoder is:	<DecoderName>**baudot115.bin**</DecoderName>

```
<?xml version="1.0" encoding="utf-8" ?>
<Modem version="1.0">
  <ModemID>2069</ModemID>
  <Name>Baudot async 50Bd 450Hz</Name>
  <NameAbbr></NameAbbr>
  <ModemVersion>0</ModemVersion>
  <PrimaryModulationType>3</PrimaryModulationType>
  <DemodulatorType>4</DemodulatorType>
  <OffsetNominalFrequency>0</OffsetNominalFrequency>
  <MinSSOSearchFrequency>-500</MinSSOSearchFrequency>
  <MaxSSOSearchFrequency>500</MaxSSOSearchFrequency>
  <F7bMode>8</F7bMode>
  <CloverType>1</CloverType>
  <PactorType>0</PactorType>
  <BaudRate>50</BaudRate>
  <BaudRateTolerance>5</BaudRateTolerance>
  <BaudRate2>50</BaudRate2>
  <BaudRateTolerance2>5</BaudRateTolerance2>
  <ModulationOrder>2</ModulationOrder>
  <Shift>450</Shift>
  <ShiftTolerance>10</ShiftTolerance>
  <FSKModemType>2</FSKModemType>
  <GMSK_BT>-1</GMSK_BT>
  <ChanFiltDesignWindow>0</ChanFiltDesignWindow>
  <ChanFiltLength>0</ChanFiltLength>
  <ChanFiltBW>{0}</ChanFiltBW>
  <ChanFiltForm>{0}</ChanFiltForm>
  <ChanFiltAlpha>{0}</ChanFiltAlpha>
  <MomApplyMedian>1</MomApplyMedian>
  <MomFiltDesignWindow>0</MomFiltDesignWindow>
  <MomFiltLength>0</MomFiltLength>
  <MomFiltBW>{0}</MomFiltBW>
  <MomFiltForm>{0}</MomFiltForm>
  <MomFiltAlpha>{0}</MomFiltAlpha>
  <BurstMode>0</BurstMode>
  <BurstMinPauseDuration>0.100000001</BurstMinPauseDuration>
  <BurstMinDuration>0.100000001</BurstMinDuration>
  <BurstMaxDuration>1</BurstMaxDuration>
  <BurstMaxMeasDuration>0</BurstMaxMeasDuration>
  <BurstMinSNR>0</BurstMinSNR>
  <PSKVersion>1</PSKVersion>
  <Equalisation>0</Equalisation>
  <VNormType>0</VNormType>
  <ToneDuration>0.100000001</ToneDuration>
  <ToneDurationTolerance>0.00999999978</ToneDurationTolerance>
  <ToneNumber>2</ToneNumber>
  <ToneDistance>5</ToneDistance>
  <MarkToneFrequency>1400</MarkToneFrequency>
  <SpaceToneFrequency>1600</SpaceToneFrequency>
  <NumberOfChannels>2</NumberOfChannels>
  <ChannelPositioning>0</ChannelPositioning>
  <ChannelDistance>5</ChannelDistance>
  <SymbolTable>[1]</SymbolTable>
  <FrequencyList>{0}</FrequencyList>
  <DecoderID>1</DecoderID>
```

```
  <DecoderID2>-1</DecoderID2>
  <DecoderName>baudot115</DecoderName>
  <DecoderNameAbbr></DecoderNameAbbr>
  <DecoderName2></DecoderName2>
  <DecoderNameAbbr2></DecoderNameAbbr2>
  <VoiceModulationType>0</VoiceModulationType>
  <VoiceDetectorSensitivity>0</VoiceDetectorSensitivity>
  <SELCALLType>0</SELCALLType>
  <KeyingRateType>3</KeyingRateType>
  <KeyingRate>250</KeyingRate>
  <KeyingRateTolerance>250</KeyingRateTolerance>
  <KeyingRate2>50</KeyingRate2>
  <KeyingRateTolerance2>0.100000001</KeyingRateTolerance2>
  <CarrierMeasureMode>0</CarrierMeasureMode>
  <PreCarrierPosition>1</PreCarrierPosition>
  <PreCarrierDuration>9.99999975e-06</PreCarrierDuration>
  <PrePreCarrierPosition>1</PrePreCarrierPosition>
  <PrePreCarrierDuration>9.99999997e-07</PrePreCarrierDuration>
  <PostCarrierPosition>1</PostCarrierPosition>
  <PostCarrierDuration>9.99999975e-06</PostCarrierDuration>
  <PostPostCarrierPosition>1</PostPostCarrierPosition>
  <PostPostCarrierDuration>9.99999997e-07</PostPostCarrierDuration>
  <FMBandwidth>7000</FMBandwidth>
  <Deemphasis>-1</Deemphasis>
  <FHSS_FreqResolution>-1</FHSS_FreqResolution>
  <FHSS_FreqDistance>-1</FHSS_FreqDistance>
  <FHSS_NumberOfFreqs>-1</FHSS_NumberOfFreqs>
  <OFDMNumberOfChannels>4</OFDMNumberOfChannels>
  <OFDMNumberOfSpecialChannels>0</OFDMNumberOfSpecialChannels>
  <OFDMChannelModulationType>11</OFDMChannelModulationType>
  <OFDMPhaseFirstChannel>0</OFDMPhaseFirstChannel>
  <OFDMPhaseRotationPerChannel>0</OFDMPhaseRotationPerChannel>
  <OFDMFrequencyFirstChannel>0</OFDMFrequencyFirstChannel>
  <OFDMFrequencyRotationPerChannel>0</OFDMFrequencyRotationPerChannel>
  <OFDMSpecialChannelIdx>{0}</OFDMSpecialChannelIdx>
  <OFDMSpecialChannelModulation>{0}</OFDMSpecialChannelModulation>
  <OFDMSpecialChannelPilotPhase>{0}</OFDMSpecialChannelPilotPhase>
  <OFDMSpecialChannelLevel>{0}</OFDMSpecialChannelLevel>
  <EnergyPatternDescription></EnergyPatternDescription>
  <ExtModemName></ExtModemName>
  <ExtModemMode></ExtModemMode>
  <ExtModemUsage>0</ExtModemUsage>
  <ExtProductionModemID>0</ExtProductionModemID>
  <AudioInWav>0</AudioInWav>
</Modem>
```

bin, txt Files

Decoders are delivered in files with the extension *bin*. A binary file contains intermediate code which is processed by the APC of go2DECODE.

The source-code for the decoder files is written in the decoder description language DDL, which is compiled into intermediate code. The *ver*-file provides the parameters for fine tuning of a specific modem.

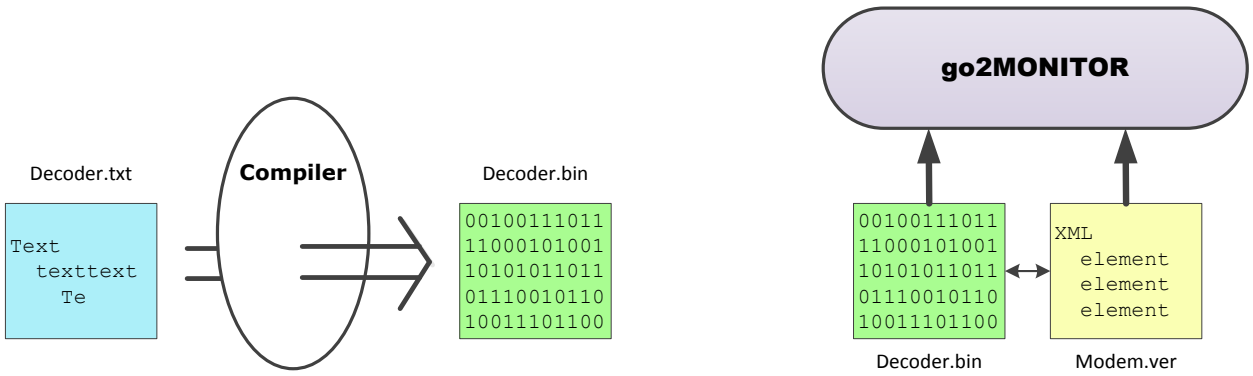


Figure 77: Generation and Application of bin-Files

The compiler and the standard decoder txt files are part of go2DECODE Standard. The additional debugger is part of go2DECODE Professional.

Using txt files containing DDL has many advantages:

- Simple code as DDL contains powerful, optimized and specialized commands to process data communication
- Fast programming and testing
- No need to depend on people who are no members of your organization, program or modify your decoders without releasing proprietary information

cmf files

A XML-file which holds the information about the modem list setup in go2DECODE. These files are identified by the extension *cmf* and may not be edited!

Station List CSV File

Field	Description	Comment
station_id	Varchar	Must contain an unique number
Frequency	Not empty, varchar	In kHz
Station	Varchar	
Modulation	Varchar	
code	Varchar	
Bw	Varchar	Hz
Baudrate	Varchar	
Callsign	Varchar	
Lang	Varchar	
ITU	Varchar	
Schedule	Varchar	
Service	Varchar	
Settings	Varchar	
Comments	Varchar	
Src	Varchar	
Date	Varchar	01-Jan-2013

Field	Description	Comment
Active	Varchar	Yes/No
Delivered	Varchar	Yes/No
UID	Varchar	

Table 20: Stations List Fields for CSV Import and Export

Specifications

System

Parameter	Specification
Data acquisition	Up to 1 MHz bandwidth Digital IF (complex baseband I/Q) Digital AF (complex WAV 8, 16, 32 Bit) RAW IF File Format Others on request
Localization	English Others on request
Documentation	Printed user manual / PDF Online-Help
Recommended PC hardware	CPU: Pentium IV, Multicore 2 GHz Memory: 4 GB RAM HDD: > 500 GB recommended (depends on recordings) Screen Resolution: >1920 x 1080 Pixel (multiple monitors recommended) Fast Ethernet for digital IF input
OS	Windows XP/7 Linux on request

Supported Receivers

The following receivers are supported by go2MONITOR:

Receiver	Interface	Comment
GEW GRX-LAN	LAN	See manual for IP-settings instructions
IZT R30XX IZT R32XX IZT R33XX	LAN	Initialization of the receiver (start streaming to the specific IP-address) has to be done by using IZT control software. Also, frequency and bandwidth has to be controlled by using IZT control software. See below for IP-settings instructions
Microtelecom PERSEUS	USB	
National Instruments	ask	
Other generic “Winrad ExtIO” supported receivers		Experimental support
PLATH DBT 5400 + VDC	ask	
R&S EB 200	ask	
R&S EM 510	ask	
R&S EM100	LAN	See manual for IP-settings instructions
RFSPACE SDR-14	USB	

Receiver	Interface	Comment
RFSPACE SDR-IQ	USB	
RTLSDR / Noxon USB-stick	USB	Experimental support
WiNRADiO WR-G31DDC	USB/PCI	
WiNRADiO WR-G39DDC	USB/PCI	
WJ 86XX	ask	
WJ 87XX	ask	

Table 21: List of Supported Receivers

Classifier

Technical Parameters	Specification	Recognition quality,(EB/No) for a detection rate >90% and false alarms <1%
Max. signal bandwidth	HF 20 kHz V/UHF 50 kHz	
Min. carrier to noise ratio	6 dB	
J3E LSB/USB, A3E AM, F3E NFM		
Morse	30-250 CPM	
FSK2	HF: 25-4800 Bd V/UHF: 1.2-25 kBd m = 0.5-10	11-15 dB
FSK4	HF: 25-4800 Bd V/UHF: 1.2-25 kBd	11 - 15 dB
MSK	HF: 25-4800 Bd V/UHF: 1.2-25 kBd	
Multitone FSKn	3-200 ms (5-330 Bd) 5-64 tones	11-15 dB
(D)PSK 2 A/B	HF: 25-4800 Bd V/UHF: 1.2-25 kBd	7-10 dB A/B Decision: 8-10 dB
(D)PSK 4 A/B	HF: 25-4800 Bd V/UHF: 1.2-25 kBd	8-12 dB A/B Decision: 10-12 dB
(D)PSK 8 A/B	HF: 25-4800 Bd V/UHF: 1.2-25 kBd	HF: 8-12 dB A/B Decision: 10-14 dB V-/UHF: 10-14 dB, A/B Decision: 12-14 dB

Table 22: Technical Classification Parameters

Parameter	Description	Car.	FSK	MFSK	CW	PSK	Voic	Unkn
Modulation	The type of modulation and its probability	x	x	x	x	x	x	x
Pitch	TBD						x	
Type	Type of voice like LSB, USB, AM , FM						x	
Symbol rate	The symbol rate in Bd		x	x		x		
Order	The number of phase shifts					x		
Version	Version of PSK A or B					x		

Parameter	Description	Car.	FSK	MFSK	CW	PSK	Voic	Unkn
CPM	Transmitted character per minute				x			
Dash Dot Ratio	The ratio between the length of dashes and dots				x			
Shift	The measured shift		x					
Tone distance	The measured distance between tones in Hz			x				
Frequency	The receiver center frequency of the signal	x	x	x	x	x	x	
Bandwidth	The overall bandwidth of the signal	x	x	x	x	x	x	x
SNR	The signal to noise ratio in dB	x	x	x	x	x	x	x
Signal time	Time of measurement	x	x	x	x	x	x	x

Table 23: Classifier Results Parameters

Demodulators

Demodulator Name
A3E
ASK2
ASK2PSK8
ASK4PSK8
CW
DPSK 2, 4, 8 A/B
F1A
F3E
F6
F7B
FSK 2 matched filter
FSK 2, 3, 4
GMSK
J3E (USB, LSB)
MDPSK 2, 4
MFSK 2
MPSK 2, 4
MSK
Multitone (FSKn)
OFDM
OQPSK
PSK2, 4, 8 A/B
QAM 16, 32, 64, 128, 256
TFM3
Fast adaptive equalizer using known training sequences (via DDL)
Primary demodulation SSB/AM/FM

Table 24: Demodulator List

Decoder List

Modem	Det	Prod	Same as	Modem File
2 channel ITA-2 RTTY	X	X	F7B Morse/Baudot	
ACARS HF	X	X	HFDL	
Alcatel 801H	X	-		alcatel_801h.ver
ALIS	X	X		alis.ver
ALIS 2	X	-		alis2.ver
AMOR	X	X	CIS-14	
AMOR 96	X	X	CIS-14	
AMTOR	X	X	SITOR-A	
Annex-10	X	X	ICAO Selcal	
ARQ-1000 duplex	X	X	ARQ-E/ARQ-N	
ARQ-28	X	X	ARQ-M2 242/ARQ-M4 242	
ARQ-58	X	X	ARQ-M2 342/ARQ-M4 342	
ARQ6-90	X	X		arq_6-90.ver
ARQ6-98	X	X		arq_6-98.ver
ARQ-E Cyc4	X	X		arq_e_cyc4_85bd_170hz.ver
ARQ-E Cyc8 185Bd 370Hz	X	X		arq_e_cyc8_185bd_370hz.ver
ARQ-E Cyc8 96Bd 192Hz	X	X		arq_e_cyc8_96bd_192hz.ver
ARQ-E3 50Bd 400Hz	X	X		arq_e3_50bd_400hz.ver
ARQ-E3 100Bd 400Hz	X	X		arq_e3_100bd_400hz.ver
ARQ-M1	X	X	ARQ-E3	
ARQ-M2-242	X	X		arq_m2_242_96bd_430hz.ver
ARQ-M2-342	X	X		arq_m2_342_96bd_400hz.ver
ARQ-M2-342 200Bd 410Hz	X	X		arq_m2_342_200bd_410hz.ver
ARQ-M4-242	X	X		arq_m4_242_192bd_173hz.ver
ARQ-M4-342	X	X		arq_m4_342_192bd_400hz.ver
ARQ-N	X	X		arq_n.ver
ARQ-SWE	X	X	SWED-ARQ	
ARTRAC	X	X	DUP-ARQ	
ASCII 7Bit	X	X		ascii_7bit_100bd_173hz.ver
ASCII 8Bit	X	X		ascii_8bit_180bd_500hz.ver
AUTOSPEC	X	X		autospec.ver
Baudot sync 200Bd 850Hz	X	X		baudot_sync_200bd_850hz.ver
Baudot sync 2 stopbit 50Bd 450Hz	X	X		baudot_2stopbit_50bd_450hz.ver
Baudot sync 2 stopbit 75Bd 500Hz	X	X		baudot_2stopbit_75bd_500hz.ver
Baudot async 1,5 Stopbit 50Bd 450Hz	X	X		baudot_async_50bd_450hz.ver

Modem	Det	Prod	Same as	Modem File
Baudot async 1,5 Stopbit 50Bd 170Hz	X	X		baudot_async_50bd_170hz.ver
Baudot F7B			F7B Morse/Baudot	
BEE	X	X	CIS-36-50	
BF6 Baudot	X	X	F7B Morse/Baudot	
BULG-ASCII	X	X		bulg-ascii_75bd_510hz.ver
CCIR 242	X	X	ARQ-M2 242/ARQ-M4 242	
CCIR 342	X	X	ARQ-M2 242	
CCIR 342-2	X	X	ARQ-M4 242	
CCIR 476 A/B	X	X	Sitor A/Sitor B	
CCIR 493-4	X	X	CODAN Selcal	
CCIR 518 Variant	X	X	SWED-ARQ/ARQ6-90/ARQ6-98/POL-ARQ	
CCIR 519 Variant	X	X	ARQ-E3	
CHU	X	X		chu_fsk.ver
CIS 10 11 11	X	X	CIS 36	
CIS-11	X	X		cis-11.ver
CIS-12 PSK2	X	X		cis-12_psk2.ver
CIS-12 PSK4	X	X		cis-12_psk4.ver
CIS-14	X	X		cis-14.ver
CIS-20	X	X	CIS-12	
CIS-36	X	X		cis-36.ver
CIS-36-50	X	X		cis-36_50_50bd_250hz.ver
CIS 405 3915	X	X		cis_405_3915.ver
CIS 81	X	X	CIS 81-81	
CIS 81-29	X	X	CIS 81-81	
CIS-81-81	X	X		cis-81-81_81bd_500hz.ver
CIS AT3104	X	X	CIS-12	
Clover II	X	X		clover_II.ver
Clover 2000	X	X		clover_2000.ver
Clover 2000 Broadcast	X	X		clover_2000broadcast.ver
Clover 2500	X	X		clover_2500.ver
Clover 2500 Broadcast	X	X		clover_2500broadcast.ver
CODAN 3012 Chirp	X	X		codanchirp.ver
CODAN Selcal	X	X		codan_selcall.ver
CODAN 3012 16 Channel PSK	X	X		
CODAN 3212 16 Channel PSK	X	X		codan3212_16channel_psk.ver
CODAN 8580	X	X	CODAN Selcal	
CODAN 9001 Chirp	X	X	CODAN 3012 Chirp	
CROWD-36	X	X	CIS-36	
Coquelet-13	X	X		coquelet-13_75ms.ver
Coquelet-8	X	X		coquelet-8.ver

Modem	Det	Prod	Same as	Modem File
Coquelet-8 FEC	X	X	Coquelet-80	
Coquelet-80	X	X		coquelet-80.ver
Coquelet-100	X	X	Alcatel 801H	
Coquelet-Mk1	X	X	Coquelet13	
CW-Morse	X	X	Morse	
DGPS	X	X		dgps_200bd_msk.ver
DSC-HF	X	X		dsc-hf.ver
DUP-ARQ	X	X		dup-arq_125bd_170hz.ver
FEC-A	X	X		fec-a_145bd_850hz.ver
FEC12	X	X	Visel	
FEC 100	X	X	FEC-A	
FIRE	X	X	CIS-12	
Frost	X	X	CIS 81-81	
FROST1	X	X	CIS 405 3915	
FSK 400/500	X	-		fsk_400_500.ver
F7B Morse/Baudot	X	X		
F7B Morse	X	X		f7b_baudot_morse.ver
Globe Wireless FSK	X	X		gw_fsk_100bd_200hz.ver
Globe Wireless PSK	X	X		gw_psk_200bd_psk4.ver
Globe Wireless Pactor	X	X	Globe Wireless FSK/PSK	
GMDSS	X	X	DSC-HF	
G-TOR	X	X		g-tor_300bd_180hz.ver
Golay			G-TOR	
GW DATAPLEX	X	X	Globe Wireless FSK/PSK	
HFDL PSK-2	X	X		hfdl_psk2.ver
HNG-FEC	X	X		hng_fec.ver
Voice J3E - ICAO Selcal	X	X		voice_j3e_selcal_icao.ver
IRA-ARQ	X	X	BULG-ASCII	
ITA-2 Twin	X	X	F7B Morse/Baudot	
MD674	X	X		md674.ver
MERLIN	X	X	ALIS	
MEROD	X	X		merod.ver
MFSK-8	X	X		mfsk-8.ver
MFSK-16	X	X		mfsk-16.ver
Morse	X	X		morse_raw.ver
MS5	X	X	CIS-12	
NUM 13	X	X	SP 14	
Olivia	X	X		olivia-1000-32.ver
Packet 300-4800	X	X		packet-300-4800.ver
PACTOR I	X	X		pactor_i.ver
PACTOR I FEC	X	X		pactor_i_fec.ver
PACTOR II	X	X		pactor_ii.ver
PACTOR II FEC	X	X		pactor_ii_fec.ver

Modem	Det	Prod	Same as	Modem File
PACTOR III	X	X		pactor_iii.ver
PACTOR I/II/III	X	X		pactor.ver
Piccolo MK6	X	X		piccolo_mk6.ver
Piccolo MK12	X	X		piccolo_mk12.ver
Piccolo 6	X	X	Piccolo MK6	
Pol-ARQ	X	X		pol-arq_100bd.ver
Piccolo 12	X	X	Piccolo MK12	
PSK10	X	X		psk10.ver
PSK-AM 10Bd	X	X		psk-am_10bd.ver
PSK31	X	X		psk31.ver
PSK-AM 31Bd	X	X		psk-am_31bd.ver
PSK31-FEC	X	X		psk31fec.ver
PSK-AM 50Bd	X	X		psk-am_50bd.ver
PSK63	X	X		psk63-psk2.ver
PSK63-FEC	X	X		psk63_fec.ver
PSK125	X	X		psk125_psk2.ver
PSK125-FEC	X	X		psk125_fec.ver
PSK250	X	X		psk250.ver
PSK220-FEC	X	X		psk220_fec.ver
QPSK31	X	X		qpsk31.ver
QPSK63	X	X		
QPSK125	X	X		
QPSK250	X	X		
RAC-ARQ	X	X	MEROD	
RACAL-ARQ	X	X	MEROD	
ROU-FEC	X	X	RUM-FEC	
RS-ARQ	X	X	ALIS	
RUM-FEC	X	X		rum-fec_165bd.ver
SI-ARQ	X	X		si-arq.ver
SI-FEC	X	X		si-fec.ver
SITOR-A	X	X		sitor-a_170hz.ver
SITOR ARQ	X	X	SITOR-A	
SITOR-B 100Bd 170Hz	X	X		sitor-b_100bd_170hz.ver
SITOR-B 100Bd 400Hz	X	X		sitor-b_100bd_400hz.ver
SITOR FEC	X	X	SITOR-B	
SP14	X	X		sp14.ver
SPREAD 11	X	X	Autospec	
SPREAD 21	X	X	Autospec	
SPREAD 51	X	X		spread51.ver
Saud-FEC	X	X	RUM-FEC	
SWED-ARQ	X	X		swed_arq.ver
T-600	X	X	CIS-36-50	
TDM 242	X	X	ARQ-M2 242/ARQ-M4 242	

Modem	Det	Prod	Same as	Modem File
TDM 342	X	X	ARQ-M2 342/ARQ-M4 342	
TDM 342 1 Channel	X	X	ARQ-E3	
TOR dirty	X	X	Sitor B	
TORG 10/11	X	X	CIS-11	
Twinplex	X	X		twinplex.ver
Visel	X	X		visel.ver
Voice A3E	X	X		voice_a3e.ver
Voice A3E/J3E	X	X		voice_a3e_j3e.ver
YUG-MIL	X	X	Visel	

Table 25: HF Standard Decoders

Modem	Det	Prod	Same as	Modem File
AIS	X	X		ais.ver
ACARS VHF	X	X		acars_vhf.ver
CCITT	X	X		ccitt.ver
CCIR-1	X	X		ccir.ver
CCIR-2	X	X		ccir-2.ver
CityRuf	X	X	POCSAG	
CTCSS	X	X		ctcss.ver
DSC-VHF	X	X		dsc-vhf.ver
DMR	X	X		dmr.ver
dPMR	X	X		dpmr.ver
DZVEI	X	X		
EEA	X	X		eea.ver
EIA	X	X		eia.ver
EURO	X	X		euro.ver
EURO5	X	X	EURO	
Flex 1600Bd FSK2	X	X		flex_1600bd_fsk2.ver
Flex 1600Bd PSK2A	X	X		flex_1600bd_psk2a.ver
FMS-BOS	X	X		fms_bos.ver
GMDSS-VHF	X	X	DSC-VHF	
Golay Pager	X	X		golay_pager.ver
MPT1316	X	X	EEA	
MPT1327	X	X		mpt1327_1200bd_msk.ver
MODAT	X	X		modat.ver
NATEL	X	X		natel.ver
NMT450	X	X		nmt450.ver
Packet 1200	X	X	Packet 300	
Packet 9600	X	X		packet9600.ver
PCCIR	X	X	CCIR-1	
PDZVEI	X	X	included in ZVEI	
POCSAG	X	X		pocsag_1200bd.ver

Modem	Det	Prod	Same as	Modem File
PZVEI	X	x	included in ZVEI	
Tetra	X	X		tetra.ver
Tetrapol	X	-		tetrapol.ver
VDEW	X	X		vdew.ver
VDL 2	X	X		vdl2.ver
VDL 3	X	X		vdl3.ver
ZVEI	X	X		zvei.ver
ZVEI-1	X	X	included in ZVEI	
ZVEI-2	X	X	included in ZVEI	
ZVEI-3	X	X	included in ZVEI	
ZVEI FM Primary	X	X		zvei_fm.ver

Table 26: VUHF Standard Decoders

Modem	Det	Prod	Same as	Modem File
ALE 2G	X	X		ale.ver
CHN 4+4	X	-		chn4plus4.ver
Haegelin-Cryptos	X	X	HC-ARQ	
HC-ARQ	X	X		hc-arq.ver
LINK-11 CLEW	X	X		link-11_clew.ver
LINK-11 SLEW	X	X	STANAG 5511 SLEW	link-11_slew.ver
MD 522	X	X	MIL-M-55529A	
MIL-188-110A ser.	X	X	partly included in STANAG 4539/4415	
MIL-188-110A App. C	X	X	STANAG 4539	
MIL-188-110B ser.	X	X	partly included in STANAG 4539/4415	
MIL-188-110B App.C	X	X	partly included in STANAG 4539 HDR	
MIL-188-110 16 Tone	X	X		mil188-110_16tone.ver
MIL-188-110 39 Tone	X	X		mil188-110_39tone.ver
MIL-188-141A	X	X	ALE(2G)	
MIL-188-141B	X	X	ALE(2G)	
MIL-M-55529A	X	X		mil-m-55529a.ver
STANAG 4197	X	X		stanag4197.ver
STANAG 4285	X	X		stanag4285.ver
STANAG 4415	X	X		stanag4415.ver
STANAG 4481 (FSK)	X	X		stanag4481_fsk.ver
STANAG 4481 (PSK)	X	X		stanag4481_psk.ver
STANAG 4529	X	X		stanag4529.ver
STANAG 4539	X	X		stanag4539.ver
STANAG 4539 HDR	X	X		stanag4539-hdr.ver
STANAG 5065	X	X		stanag_5065_fsk.ver
STANAG 5066	X	X	included in STANAG 4285	
STANAG 5511	X	X	LINK11 CLEW	

Modem	Det	Prod	Same as	Modem File
STANAG 5511 SLEW	X	X	LINK11 SLEW	
TADIL A	X	X	LINK11 CLEW	
TADIL B	X	X	LINK11 CLEW	

Table 27: Premium Decoders

Note :
For Premium decoders the source-code is not available.

Standard Decoders HF

Version History

Release	Date	Editor	History
1.0	2013-07-05	MBu	Start

Available Decoders

Alcatel 801H

General Information

Alcatel-801H is an 8 tone MFSK ARQ teleprinter system.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	8
Tone length (ms)	10
Tone spacing (Hz)	100

Table 28: Alcatel 801H Characteristics

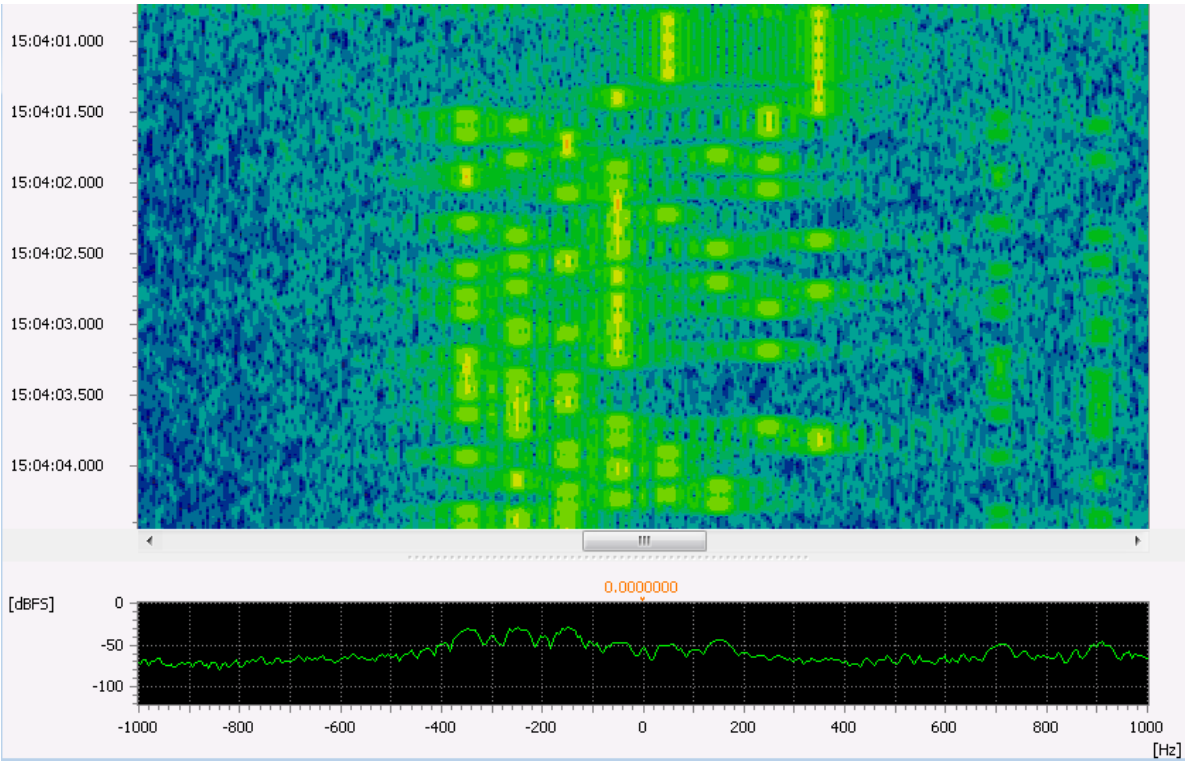


Figure 78: Alcatel 801H Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Coquelet
Tone duration (ms)	10
TD tolerance (ms)	0
No. of tones	8
Tone distance (Hz)	100
VER file name	*alcatel_801h.ver*

Table 29: Alcatel 801H Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 30: Alcatel 801H Features

ALIS

General Information

ALIS is a simplex ARQ teleprinter system developed by Rhode & Schwarz.

Usage:

- Transfer of textual information over HF with automatic Link setup.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Symbol rate (Bd)	228.7
Error correction	CRC-16
Alphabet	ITA-2

Table 31: ALIS Characteristics

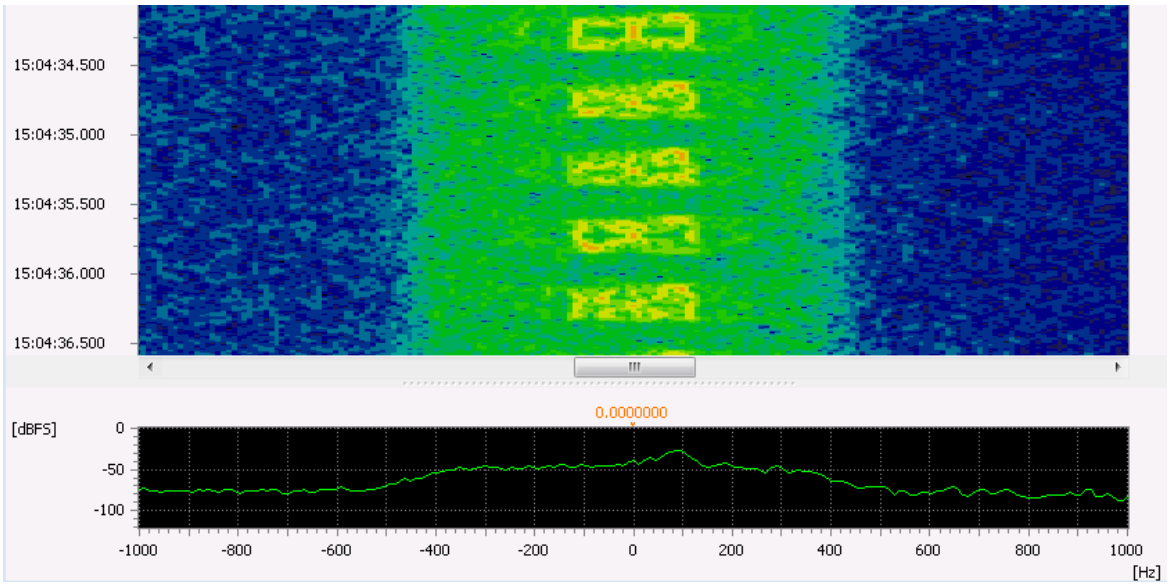


Figure 79: ALIS Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	228.67
SR tolerance (Bd)	1.000
Modulation order	2
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.210
Max. burst length (s)	0.260

Parameter	Default
Min. pause length (s)	0.010
VER file name	*alis.ver*

Table 32: ALIS Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 33: ALIS Features

ALIS-2

General Information

ALIS-2 is simplex ARQ teleprinter system developed by Rhode & Schwarz.
ALIS-2 is a further development of ALIS.

Usage:

- Transfer of textual information and binary data over HF with automatic Link setup.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	8
Tone spacing (Hz)	240
Symbol rate (Bd)	240.82
Error correction	CRC-16
Alphabet	ITA-5

Table 34: ALIS-2 Characteristics

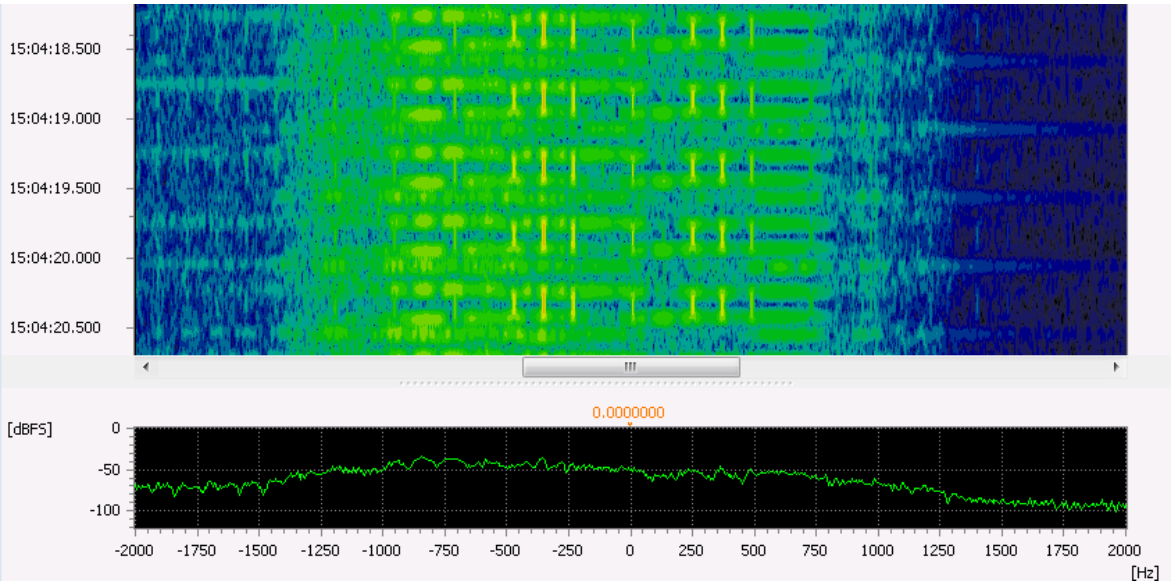


Figure 80: ALIS-2 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (FSKn)
Tone duration (ms)	4.153
TD tolerance (ms)	0.100
No. of tones	8
Tone position type	Equidistant frequencies
Tone distance (Hz)	240.816
Min. burst length (s)	0.040
Max. burst length (s)	0.350
Min. pause length (s)	0.070
VER file name	*alis2.ver*

Table 35: ALIS-2 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 36: ALIS-2 Features

ARQ-6-90

General Information

ARQ-6-90 is an ARQ mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Basic data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Bandwidth (Hz)	600
Symbol rate (Bd)	200
Error correction	ARQ
Alphabet	CCIR-476

Table 37: ARQ-6-90 Characteristics

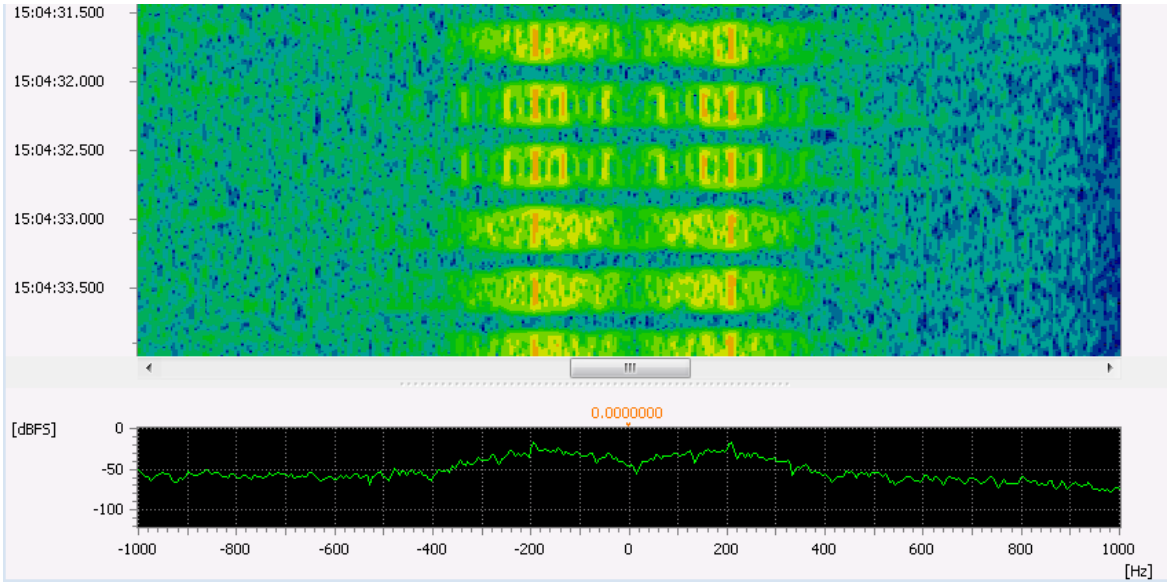


Figure 81: ARQ-6-90 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	20
Modem type	Synchronous
Min. burst length (s)	0.065

Parameter	Default
Max. burst length (s)	0.260
Min. pause length (s)	0.200
VER file name	*arq_6-90.ver*

Table 38: ARQ-6-90 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 39: ARQ-6-90 Features

ARQ-6-98

General Information

ARQ-6-98 is an ARQ mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Basic data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	400
Symbol rate (Bd)	200
Error correction	ARQ
Alphabet	CCIR-476

Table 40: ARQ-6-98 Characteristics

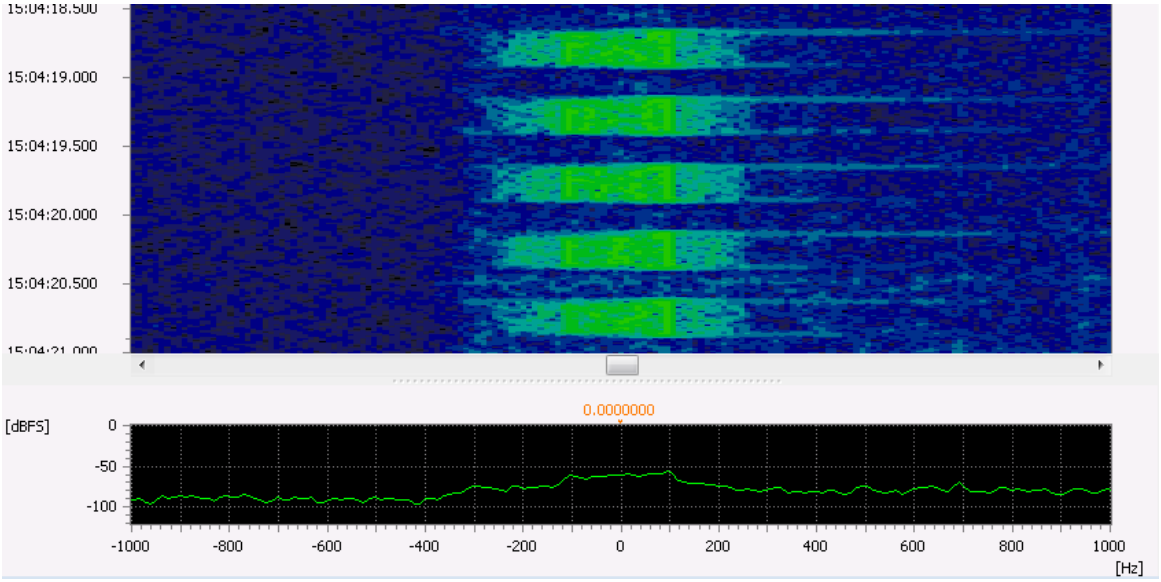


Figure 82: ARQ-6-98 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	170
Shift tolerance (Hz)	20
Modem type	Synchronous
Min. burst length (s)	0.065
Max. burst length (s)	0.260
Min. pause length (s)	0.150
VER file name	*arq_6-98.ver*

Table 41: ARQ-6-98 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 42: ARQ-6-98 Features

ARQ-E

General Information

ARQ-E is a synchronous dual channel ARQ mode for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Military or diplomatic data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170 / 370
Bandwidth (Hz)	300 / 600
Symbol rate (Bd)	30 … 650
Error correction	ARQ
Alphabet	ITA-2 extended

Table 43: ARQ-E Characteristics

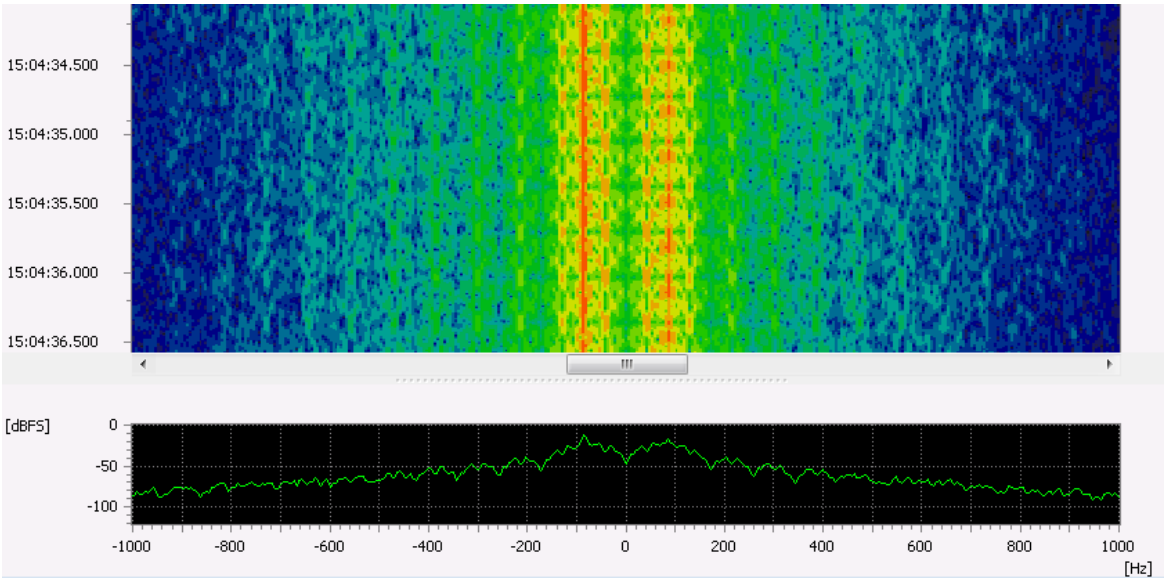


Figure 83: ARQ-E cyc4 Spectrogram

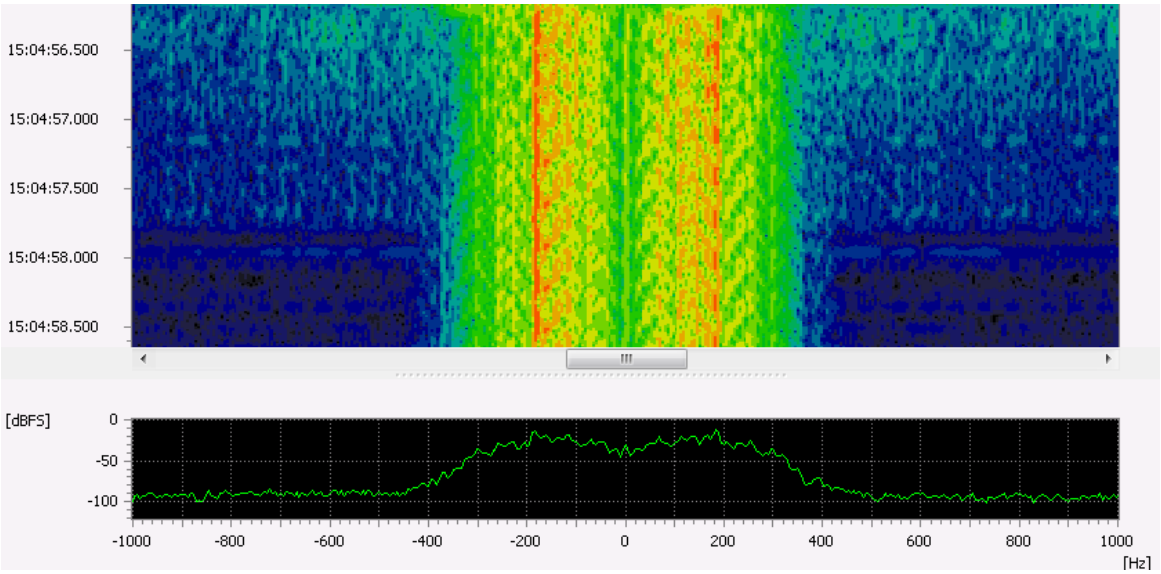


Figure 84: ARQ-E cyc8 Spectrogram

Demodulator Settings

Parameter	Default	
Demodulator	FSK 2 matched	
Symbol rate (Bd)	85.7	185
SR tolerance (Bd)	4	5
Shift (Hz)	170	370
Shift tolerance (Hz)	20	
Modem type	Synchronous	
VER file name	arq_e_cyc4_85bd_170hz.ver	arq_e_cyc8_185bd_370hz.ver

Table 44: ARQ-E Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 45: ARQ-E Features

ARQ-E3

General Information

ARQ-E3 is a synchronous dual channel ARQ mode for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Military or diplomatic data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Bandwidth (Hz)	600
Symbol rate (Bd)	30 … 650
Error correction	ARQ
Alphabet	ITA-3

Table 46: ARQ-E3 Characteristics

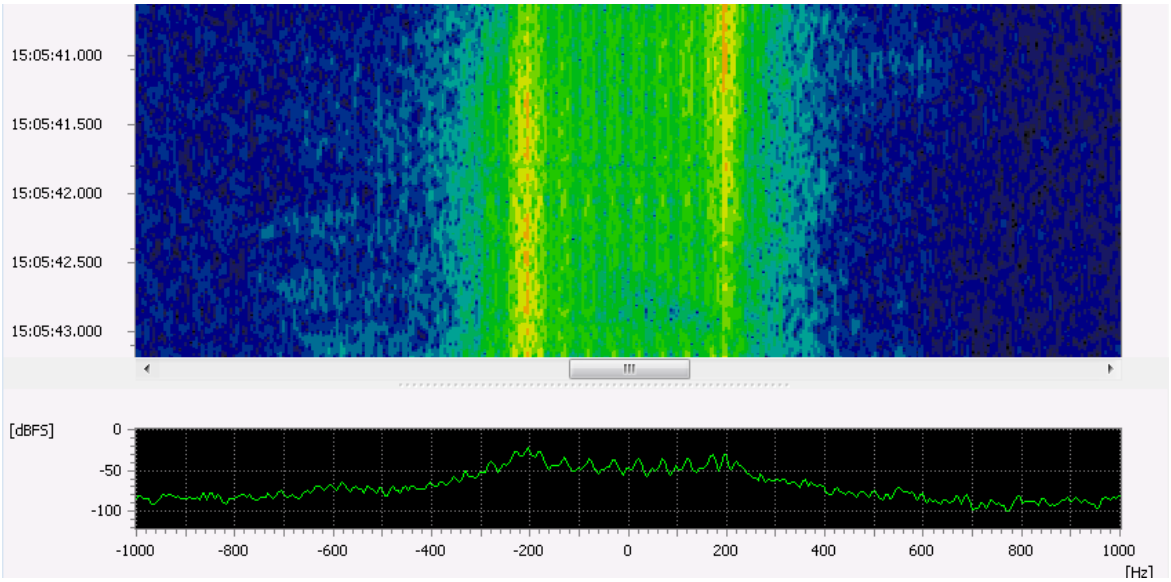


Figure 85: ARQ-E3 cyc8 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	500
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	30
Modem type	Synchronous
VER file name	*arq_e3_50bd_400hz.ver*

Table 47: ARQ-E3 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 48: ARQ-E3 Features

ARQ-M2-242

General Information

ARQ-M2-242 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	430
Bandwidth (Hz)	600 / 800
Symbol rate (Bd)	96 / 200
Alphabet	ITA-3

Table 49: ARQ-M2-242 Characteristics

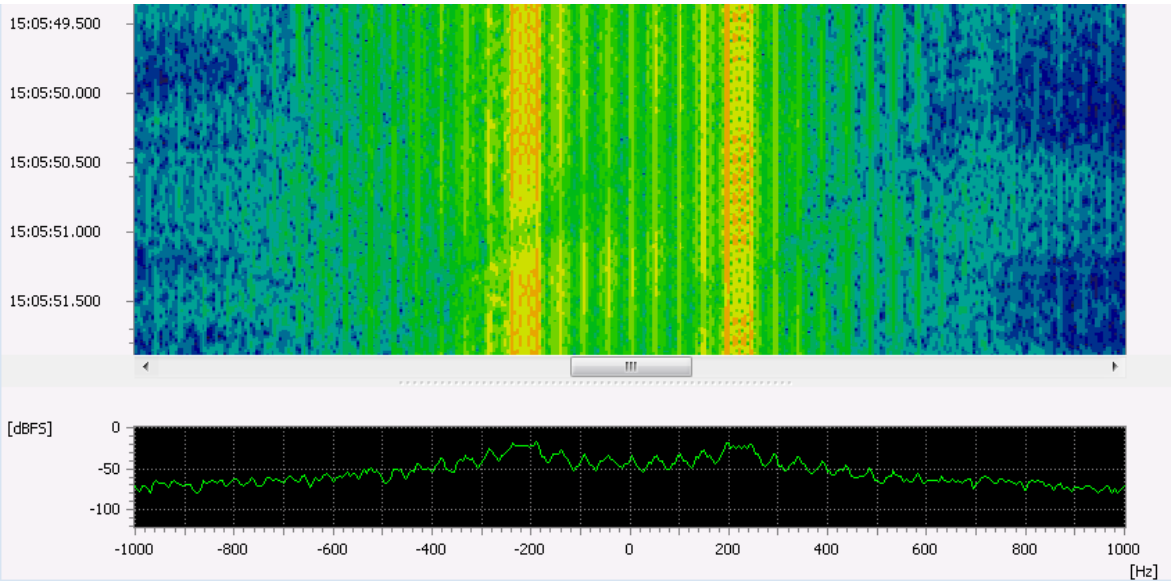


Figure 86: ARQ-M2-242 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	430
Shift tolerance (Hz)	30
Modem type	Synchronous
VER file name	*arq_m2_242_96bd_430hz.ver*

Table 50: ARQ-M2-242 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 51: ARQ-M2-242 Features

ARQ-M2-342

General Information

ARQ-M2-242 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Bandwidth (Hz)	600 / 800
Symbol rate (Bd)	96 / 200
Alphabet	ITA-3

Table 52: ARQ-M2-342 Characteristics

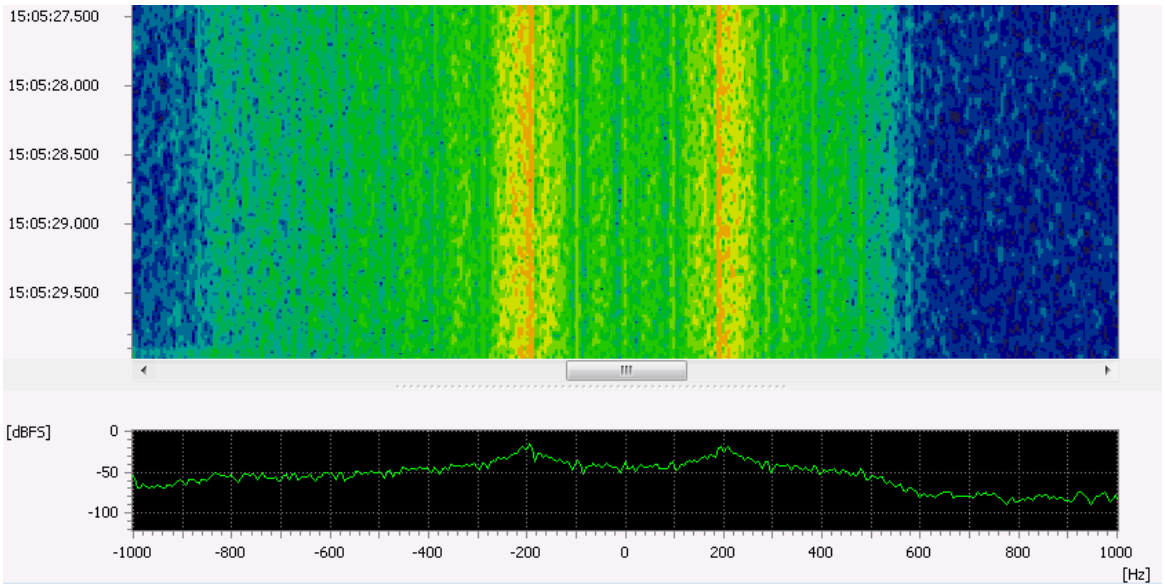


Figure 87: ARQ-M2-342 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	30
Modem type	Synchronous
VER file name	*arq_m2_342_96bd_400hz.ver*

Table 53: ARQ-M2-342 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 54: ARQ-M2-342 Features

ARQ-M4-242

General Information

ARQ-M4-242 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	400
Symbol rate (Bd)	172 / 192
Alphabet	ITA-3

Table 55: ARQ-M4-242 Characteristics

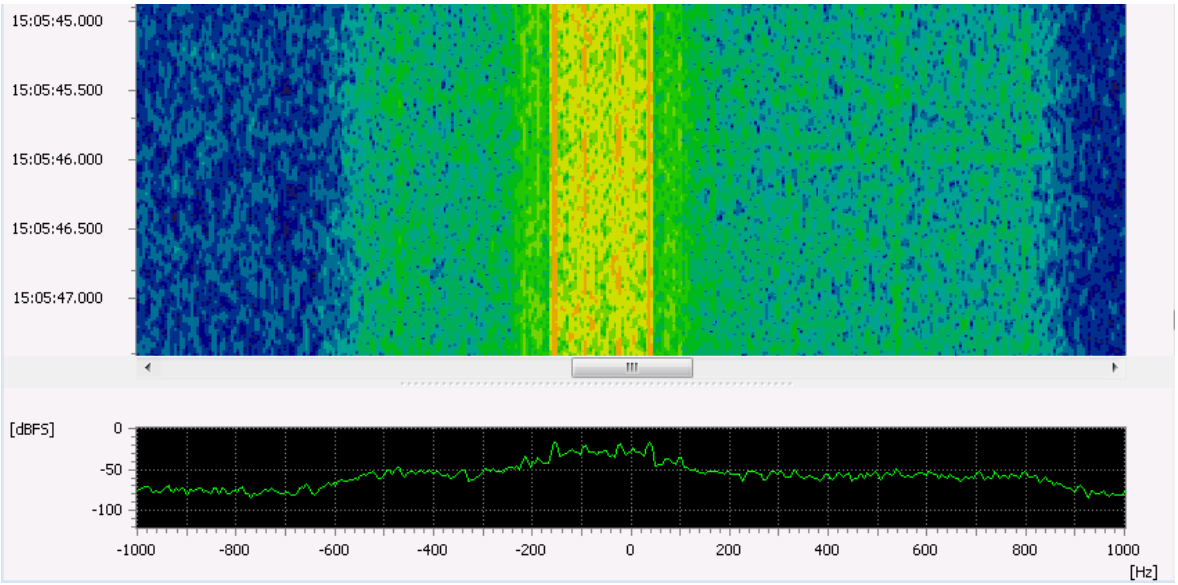


Figure 88: ARQ-M4-242 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	192
SR tolerance (Bd)	2
Modulation order	2
Shift (Hz)	173
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*arq_m4_242_192bd_173hz.ver*

Table 56: ARQ-M4-242 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 57: ARQ-M4-242 Features

ARQ-M4-342

General Information

ARQ-M4-342 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Bandwidth (Hz)	800
Symbol rate (Bd)	172 / 192
Alphabet	ITA-3

Table 58: ARQ-M4-342 Characteristics

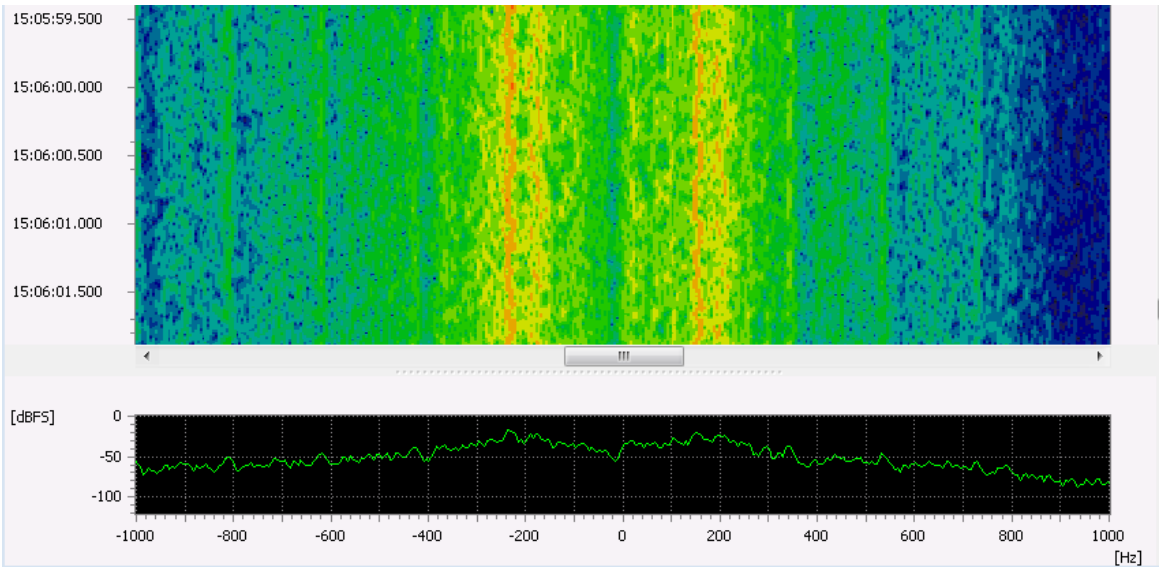


Figure 89: ARQ-M4-342 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	192
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*arq_m4_342_192bd_400hz.ver*

Table 59: ARQ-M4-342 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 60: ARQ-M4-342 Features

ARQ-N

General Information

ARQ-E is a synchronous dual channel ARQ mode. This system was used by Italian diplomatic services.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	850
Symbol rate (Bd)	96
Error correction	ARQ
Repetition cycles (char)	4,5,8
Alphabet	ITA-2P

Table 61: ARQ-N Characteristics

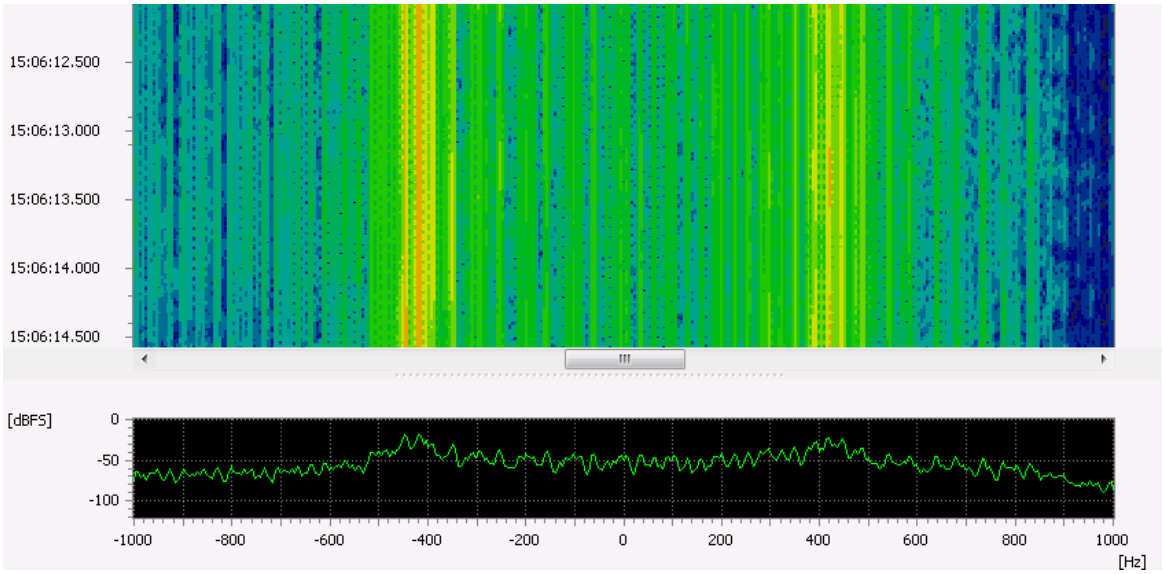


Figure 90: ARQ-N Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	850
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*arq_n.ver*

Table 62: ARQ-N Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 63: ARQ-N Features

ASCII 7 Bit

General Information

The American Standard Code for Information Interchange (ASCII) is a set of binary values to represent printable characters in electronic communication.

In the first version of the standard the character-length was 7 bit.

Usage:

- Transfer of textual information over HF.
- Processing, transfer and storage of textual information.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	173
Bandwidth (Hz)	300
Symbol rate (Bd)	100
Character	1 Start-, 7 Data-, 1 Stop-Bit

Table 64: ASCII 7 Bit Characteristics

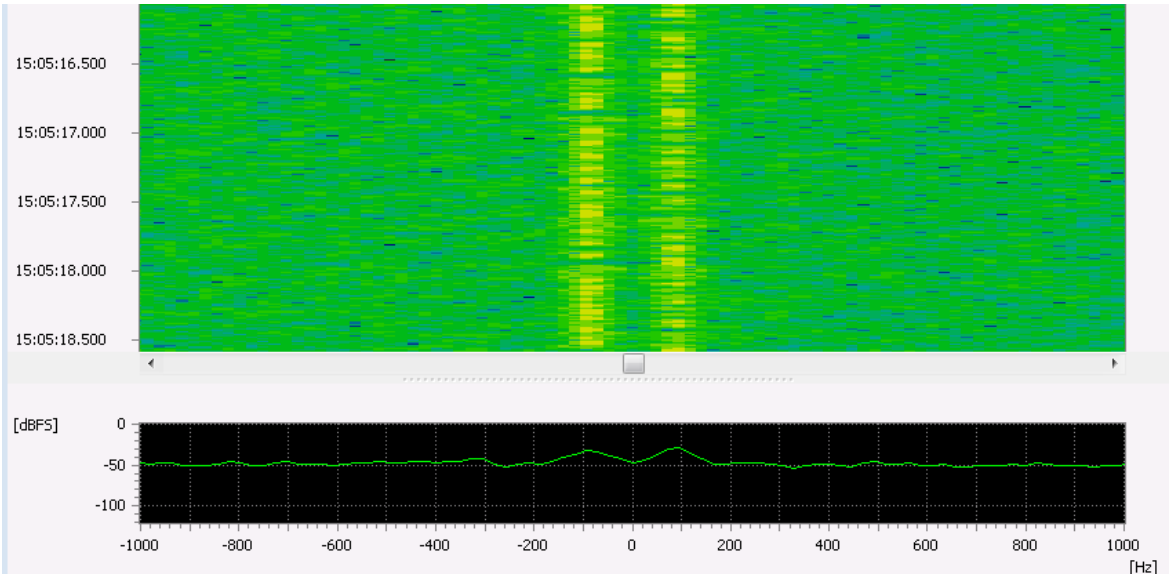


Figure 91: ASCII 7 Bit Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	173
Shift tolerance (Hz)	10
Modem type	Synchronous

Parameter	Default
VER file name	*ascii_7bit_100bd_173hz.ver*

Table 65: ASCII 7 Bit Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 66: ASCII 7 Bit Features

ASCII 8 Bit

General Information

The American Standard Code for Information Interchange (ASCII) is a set of binary values to represent printable characters in electronic communication.
In a later version of the standard the character-length was extended to 8 bit.

Usage:

- Processing, transfer and storage of textual information.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	492
Bandwidth (Hz)	700
Symbol rate (Bd)	150
Character	1 Start-, 8 Data-, 2 Stop-Bit

Table 67: ASCII 8 Bit Characteristics

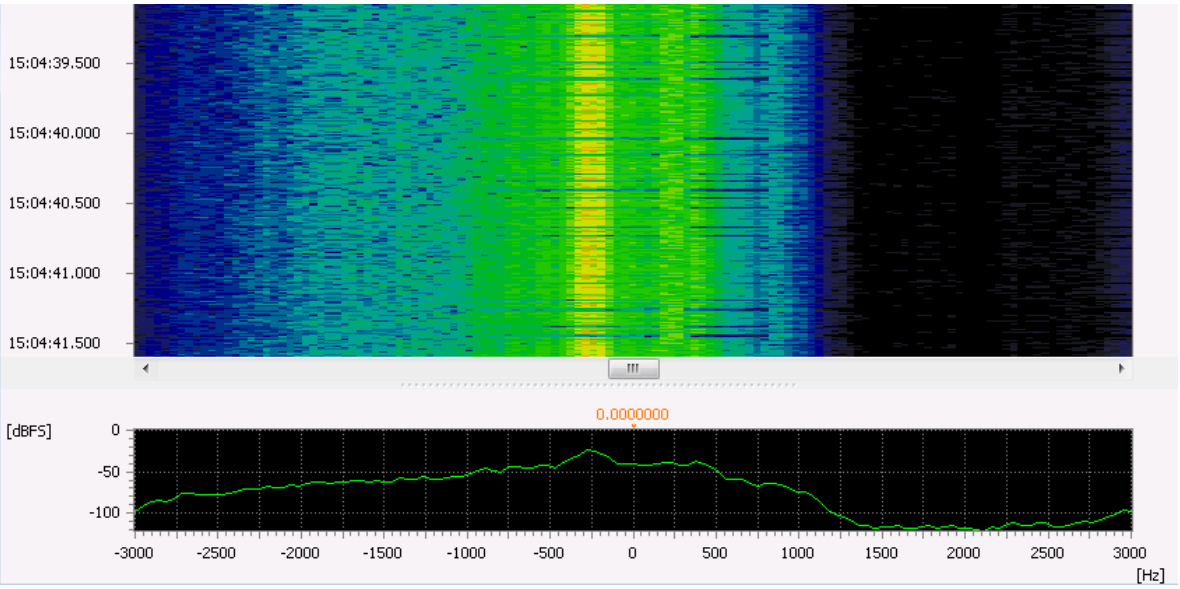


Figure 92: ASCII 8 Bit Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	180
SR tolerance (Bd)	90
Shift (Hz)	500
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*ascii_8bit_180bd_500hz.ver*

Table 68: ASCII 8 Bit Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 69: ASCII 8 Bit Features

AUTOSPEC

General Information

Autospec is a synchronous FEC system. This system was used by British coastal station for communication to oil rigs.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	270
Symbol rate (Bd)	68.5
Alphabet	ITA-2

Table 70: AUTOSPEC Characteristics

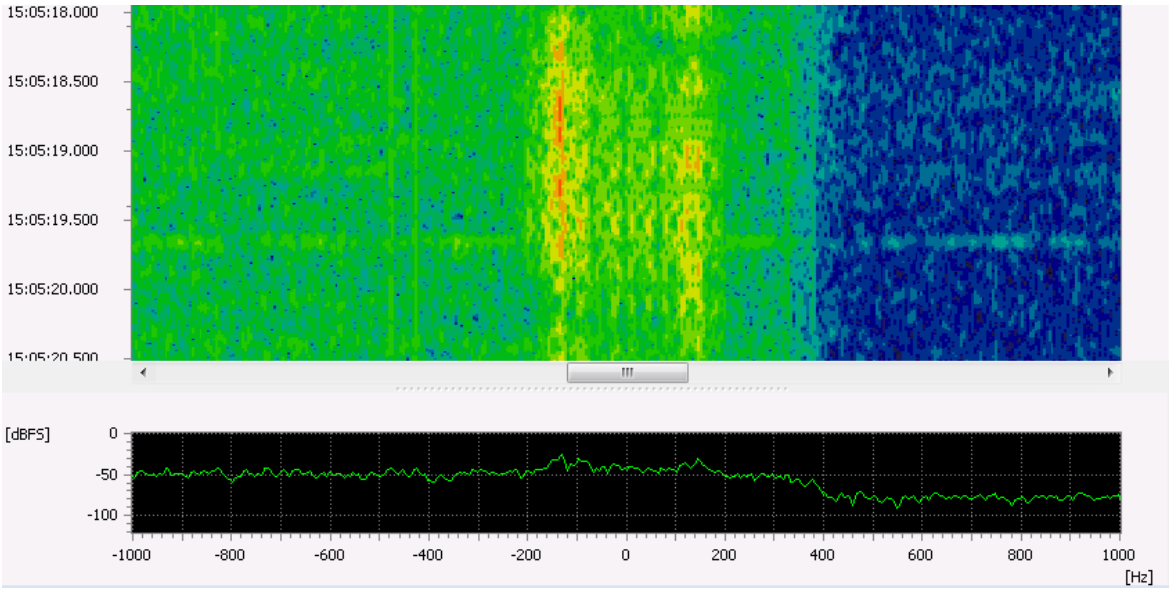


Figure 93: AUTOSPEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	68.5
SR tolerance (Bd)	1
Shift (Hz)	270
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*autospec.ver*

Table 71: AUTOSPEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 72: AUTOSPEC Features

Baudot async

General Information

The asynchronous Baudot mode is a means to transfer printable characters over a communication channel. Synchronisation in this case is achieved by the use of a Start-Bit, which has the polarity reverse to the Stop-Bit and the Idle-State.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	450 / 850
Bandwidth (Hz)	800 / 1500
Symbol rate (Bd)	50 / 75 / 100
Character	1 Start-, 5 Data-, 1/1.5/2 Stop-Bit

Table 73: Baudot async Characteristics

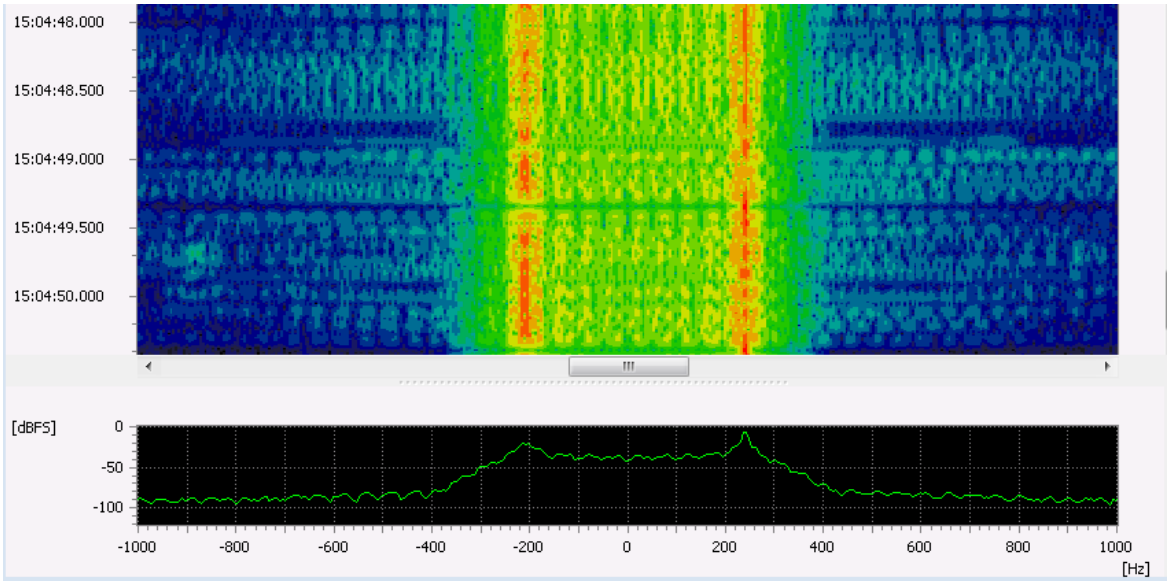


Figure 94: Baudot async Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	50
SR tolerance (Bd)	5
Shift (Hz)	450
Shift tolerance (Hz)	10
Modem type	Asynchronous
VER file name	*baudot_async_50bd_450hz.ver*

Table 74: Baudot async Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 75: Baudot async Features

Baudot sync

General Information

The synchronous Baudot mode is a means to transfer printable characters over a communication channel. Synchronisation in this case is achieved by using a fixed character-length and a combination of Start- and Stop-Bit of reverse polarity.

Usage:

- Transfer of textual information.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	450 / 850
Bandwidth (Hz)	800 / 1500
Symbol rate (Bd)	200
Character	1 Start-, 5 Data-, 1 Stop-Bit

Table 76: Baudot sync Characteristics

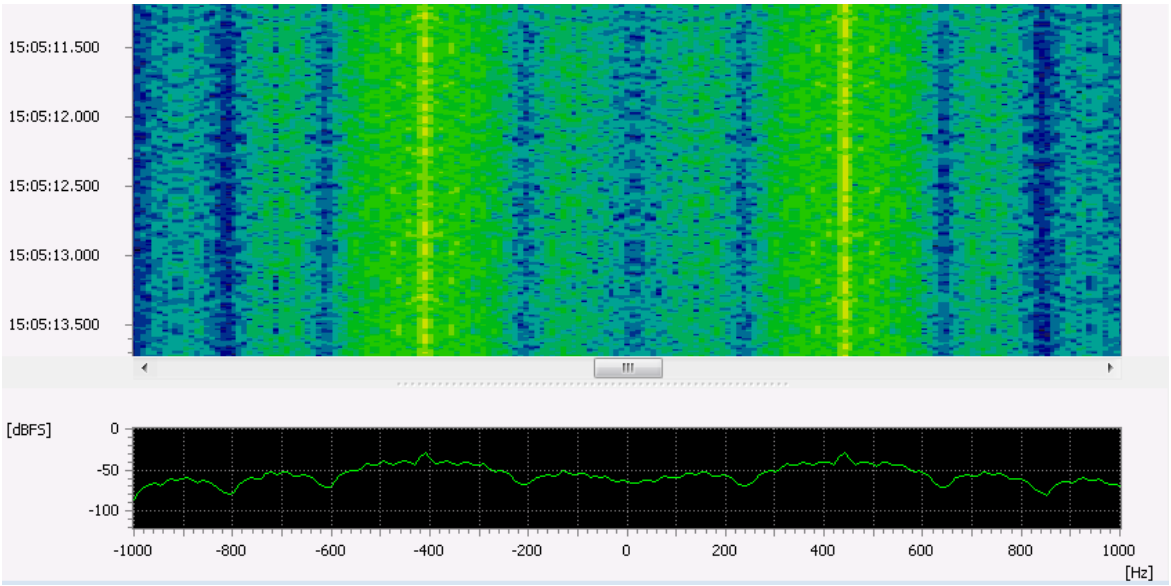


Figure 95: Baudot sync Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Shift (Hz)	850
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*baudot_sync_200bd_850hz.ver*

Table 77: Baudot sync Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 78: Baudot sync Features

BULG-ASCII

General Information

BULG-ASCII is a modem used by the Bulgarian Ministry of Foreign Affairs.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Bandwidth (Hz)	600
Symbol rate (Bd)	120

Table 79: BULG-ASCII Characteristics

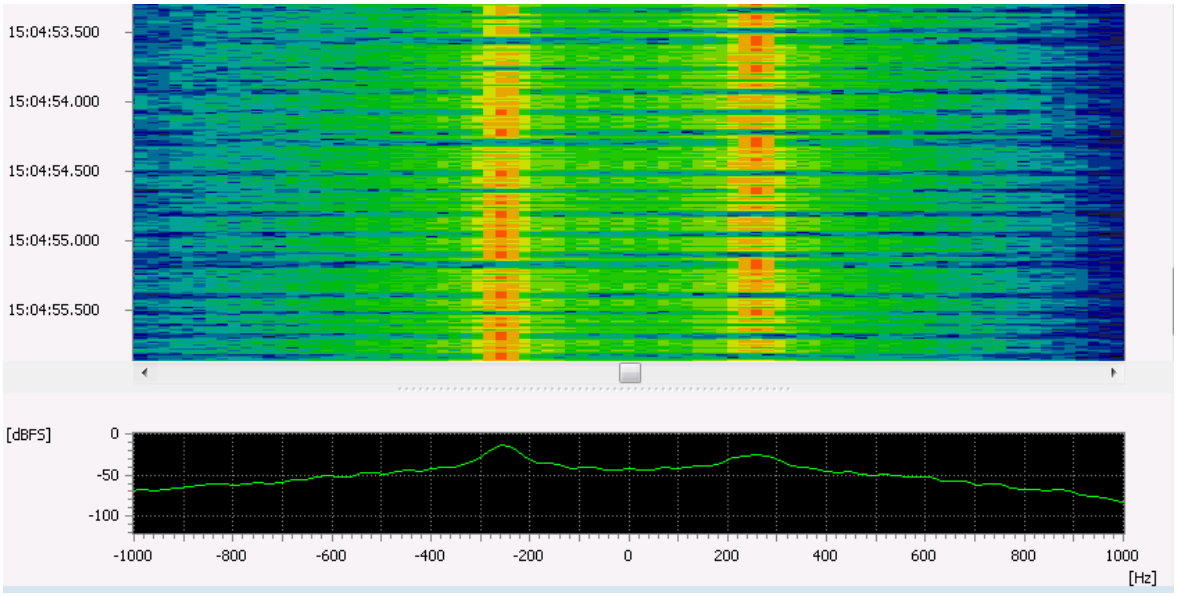


Figure 96: BULG-ASCII Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	75
SR tolerance (Bd)	10
Shift (Hz)	510
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*bulg-ascii_75bd_510hz.ver*

Table 80: BULG-ASCII Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 81: BULG-ASCII Features

CHU

General Information

CHU is a radio station in Canada that continuously broadcasts time of day information. It is operated by the National Research Council of Canada.

Usage:

- Time information broadcasts.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	500
Symbol rate (Bd)	500
Coding	BCD

Table 82: CHU Characteristics

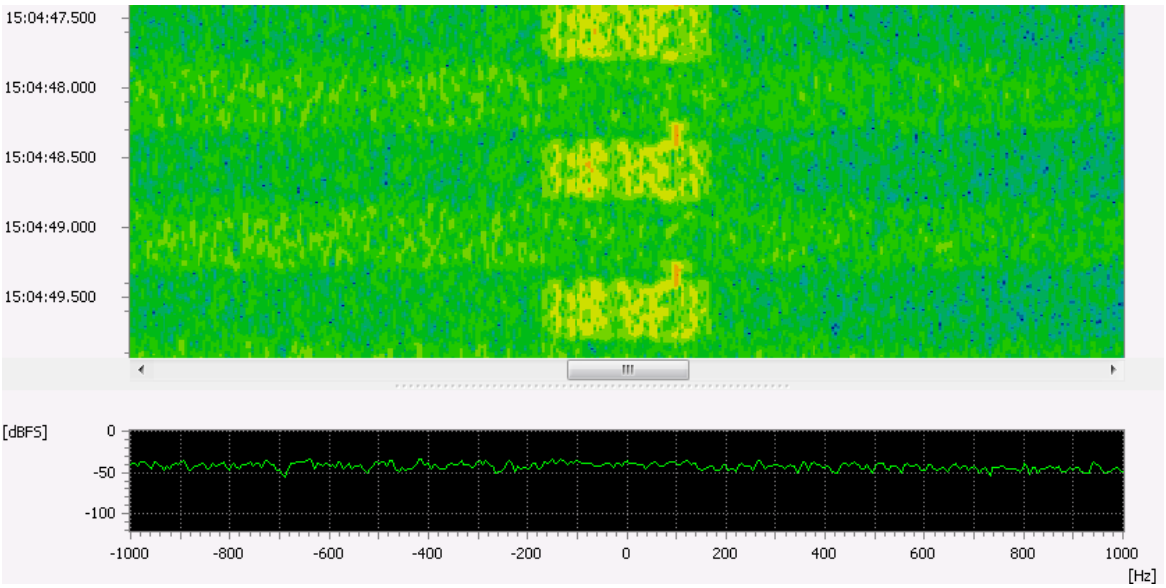


Figure 97: CHU Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	300
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	200
Shift tolerance (Hz)	5
Modem type	Synchronous
Min. burst length (s)	0.200

Parameter	Default
Max. burst length (s)	0.700
Min. pause length (s)	0.150
VER file name	*chu_fsk.ver*

Table 83: CHU Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 84: CHU Features

CIS-11

General Information

CIS-11 is a full duplex teleprinter system used in former CIS (Commonwealth of Independent States).

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Symbol rate (Bd)	100
Error correction	Parity
Alphabet	ITA-2

Table 85: CIS-11 Characteristics

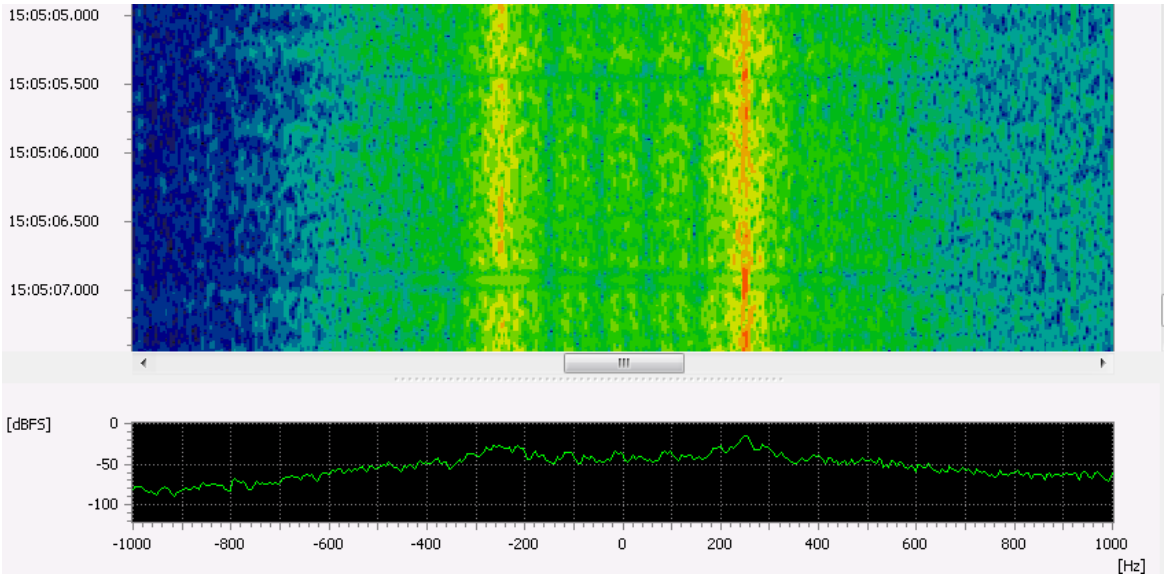


Figure 98: CIS-11 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	500
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*cis-11.ver*

Table 86: CIS-11 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 87: CIS-11 Features

CIS-12

General Information

CIS-12 is a Soviet military multi-channel modem. It features scrambled voice- or data-communication at a maximum data rate of 4800 bits/sec.
This modem system is also known as MS5 and FIRE.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	Multi-channel PSK2 / PSK4
Number of channels	2
Channel spacing (Hz)	200
Symbol rate (Baud)	120
Coding	Vocoder
Pilot tone (Hz)	3300

Table 88: CIS-12 Characteristics

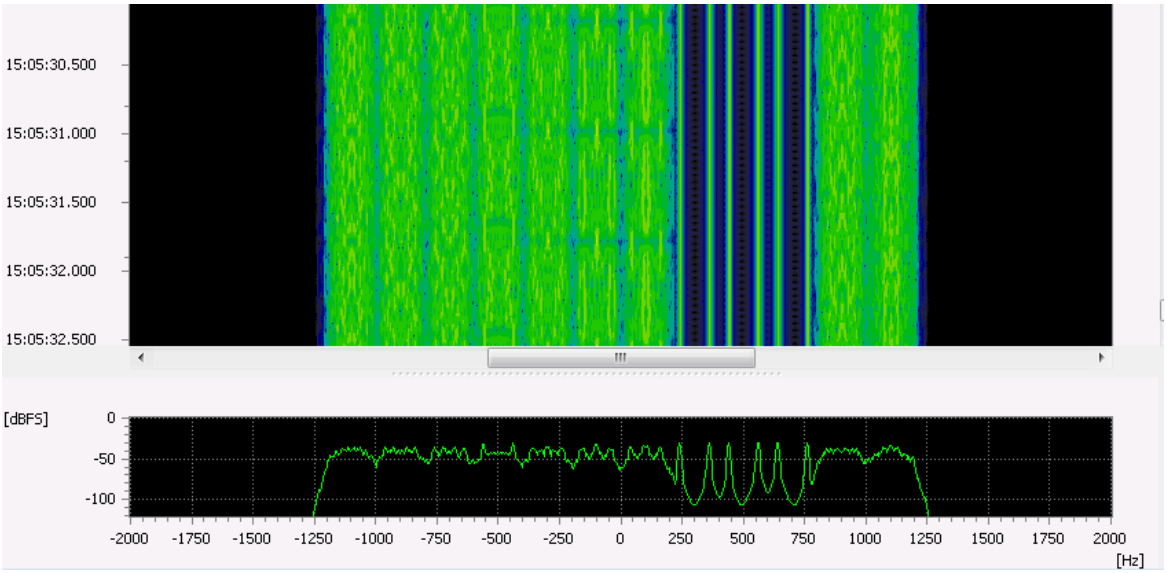


Figure 99: CIS-12 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	MDPSK 2,4,8,16 A/B
Symbol rate (Bd)	120
SR tolerance (Bd)	5
Modulation order	4
Version	A
No. of channels	12
Channel position type	Channel distance

Parameter	Default
Channel distance (Hz)	200
VER file name	*cis-12_psk4.ver*

Table 89: CIS-12 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 90: CIS-12 Features

CIS-14

General Information

CIS-14 is a synchronous duplex teleprinter system with ARQ.
This modem system is also known as AMOR and AMOR96.

Usage:

- Data communication over HF.
- Point-to-point communication between stations in CIS (Commonwealth of Independent States)-region.

Mode Properties

Parameter	Value
Modulation	FSK
Number of channels	2
Shift (Hz)	500
Bandwidth (Hz)	700
Symbol rate (Baud)	96
Coding	Parity check
Alphabet	M2 cyrillic

Table 91: CIS-14 Characteristics

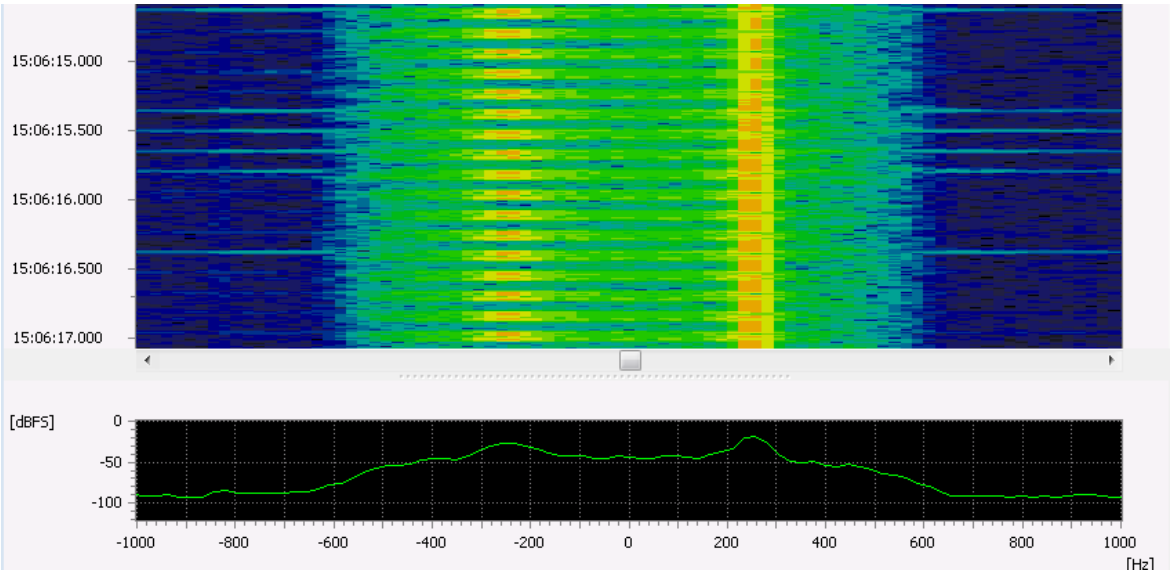


Figure 100: CIS-14 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	500
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*cis-14.ver*

Table 92: CIS-14 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 93: CIS-14 Features

CIS-36

General Information

CIS-36 is a modem used by the Soviet military and diplomatic services.
This modem system is also known as CROWD 36.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	MFSK
Number of tones	36
Tone spacing (Hz)	40
Bandwidth (Hz)	2000
Symbol rate (Baud)	40
Encryption	

Table 94: CIS-36 Characteristics

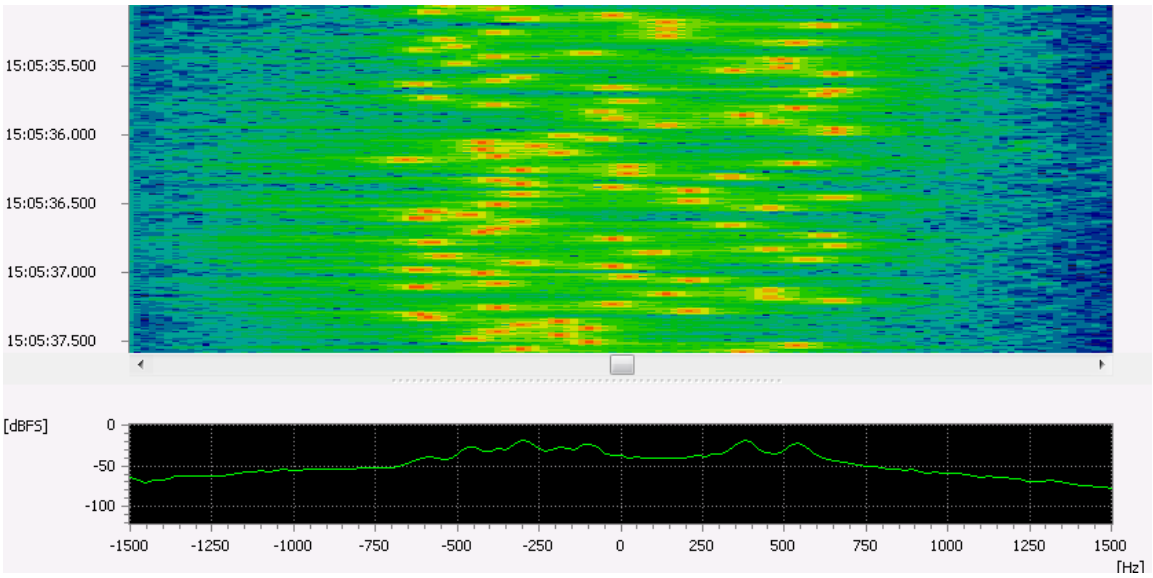


Figure 101: CIS-36 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	25
TD tolerance (ms)	2.5
No. of tones	36
Tone position type	Equidistant frequencies
Tone distance (Hz)	40
VER file name	*cis-36.ver*

Table 95: CIS-36 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 96: CIS-36 Features

CIS-36-50

General Information

CIS-36-50 is a modem used by the Soviet navy.
This modem system is also known as BEE or T600.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200 / 250 / 500
Bandwidth (Hz)	300 … 550
Symbol rate (Baud)	50
Encryption	

Table 97: CIS-36-50 Characteristics

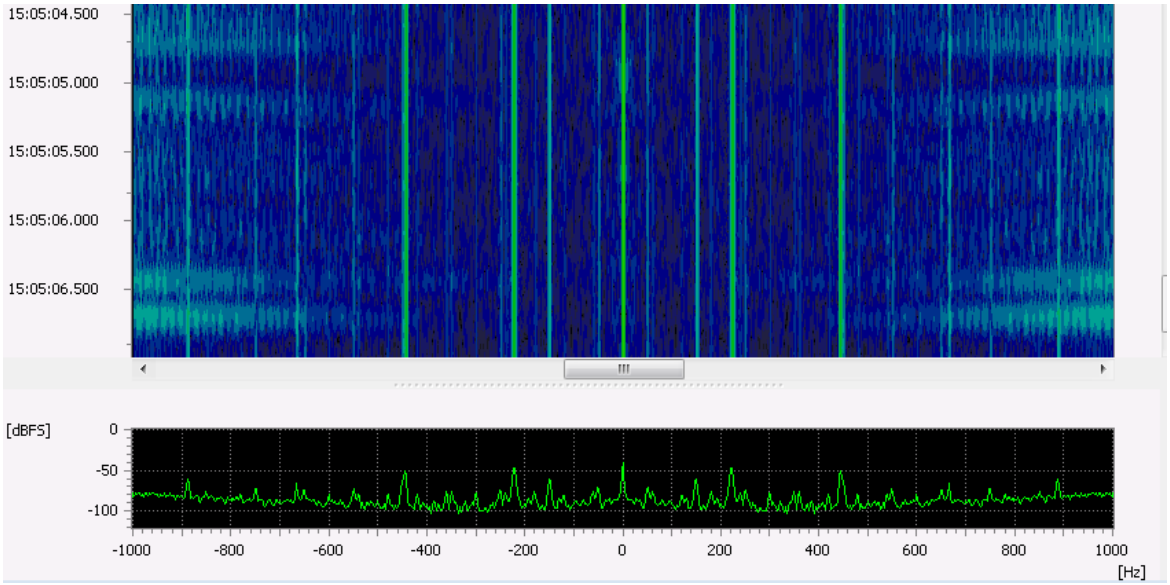


Figure 102: CIS-36-50 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	50
SR tolerance (Bd)	5
Shift (Hz)	250
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*cis-36_50_50bd_250hz.ver*

Table 98: CIS-36-50 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding (raw output)	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 99: CIS-36-50 Features

CIS 405-3915

General Information

CIS 405-3915 is a synchronous teleprinter system in a CIS-8181 variant, but uses the half baud rate. This system is used by the Soviet military and railways authorities for point to point connections. Despite its simplicity this modem is still in operation today. Traffic is always encrypted. Sometimes operator chat or station id in Morse telegraphy can be copied.

Usage:

- Transfer of textual information over HF.
- Point-to-point communication between stations in CIS (Commonwealth of Independent States)-region.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Symbol rate (Baud)	40.5
Encryption	

Table 100: CIS 405-3915 Characteristics

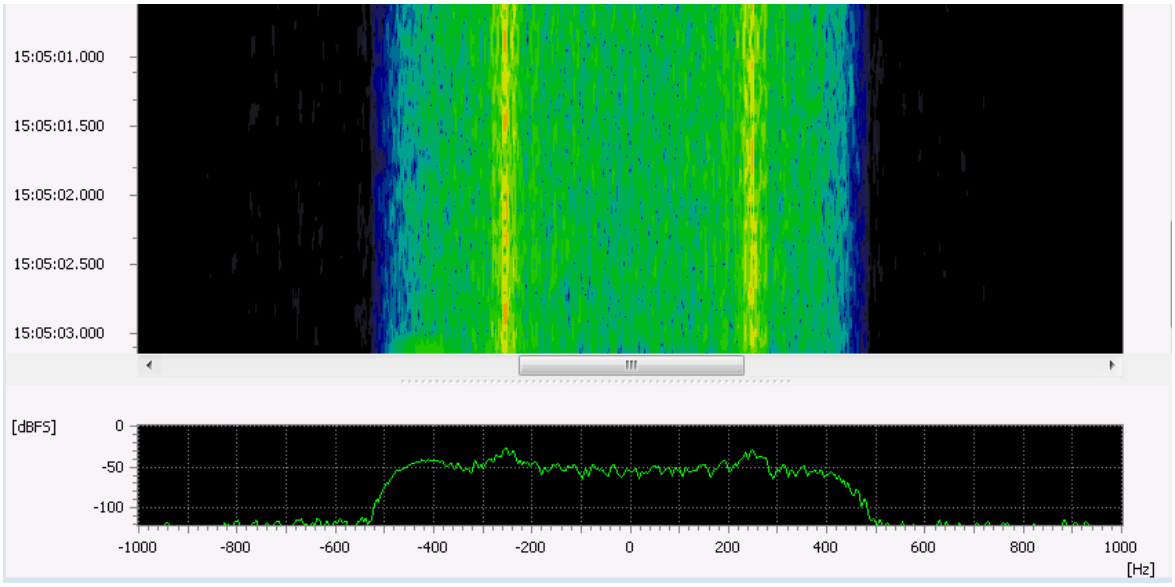


Figure 103: CIS 405-3915 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	40.5
SR tolerance (Bd)	5
Shift (Hz)	500
Shift tolerance (Hz)	10

Parameter	Default
Modem type	Synchronous
VER file name	*cis_405_3915.ver*

Table 101: CIS 405-3915 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 102: CIS 405-3915 Features

CIS-8181

General Information

CIS-8181 is a modem used by the Sovjet navy.
There is also a variant called CIS 8129.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Bandwidth (Hz)	600
Symbol rate (Baud)	81
Encryption	

Table 103: CIS-8181 Characteristics

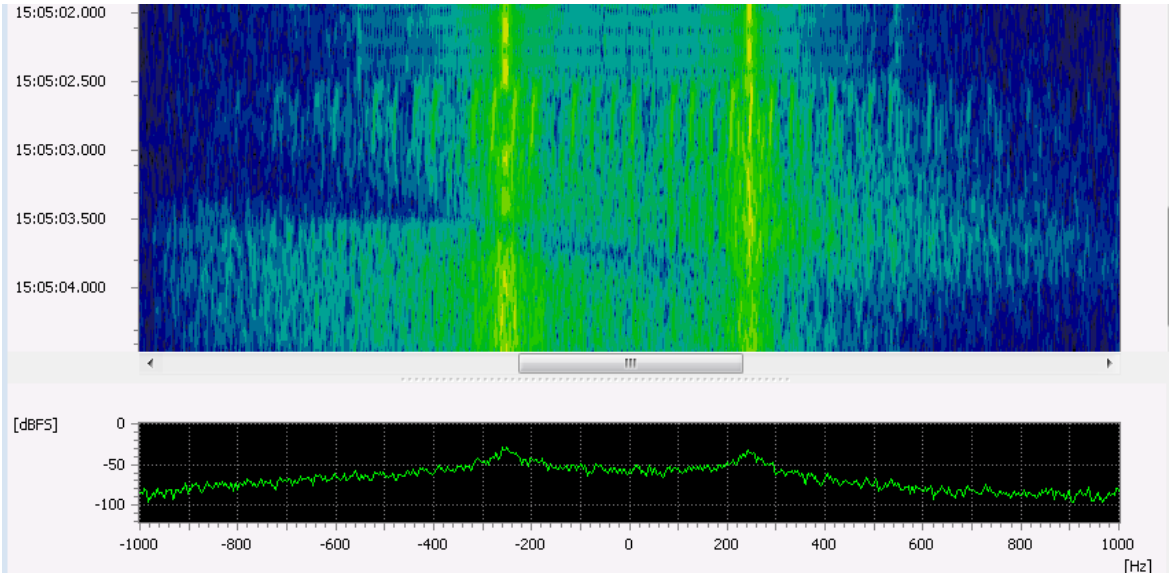


Figure 104: CIS-8181 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	81
SR tolerance (Bd)	5
Shift (Hz)	500
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*cis-81-81_81bd_500hz.ver*

Table 104: CIS-8181 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding (raw output)	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 105: CIS-8181 Features

Clover-II

General Information

Clover-II mode is a proprietary standard developed by HAL Communications Corp., USA.

Usage:

- ARQ and broadcast data communication over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK, DQPSK, 8-DPSK, 8P2A, 16P4A
Number of channels	4
Channel spacing (Hz)	125
Bandwidth (Hz)	500
Symbol rate (Baud)	31.25
Coding	Reed-Solomon

Table 106: Clover-II Characteristics

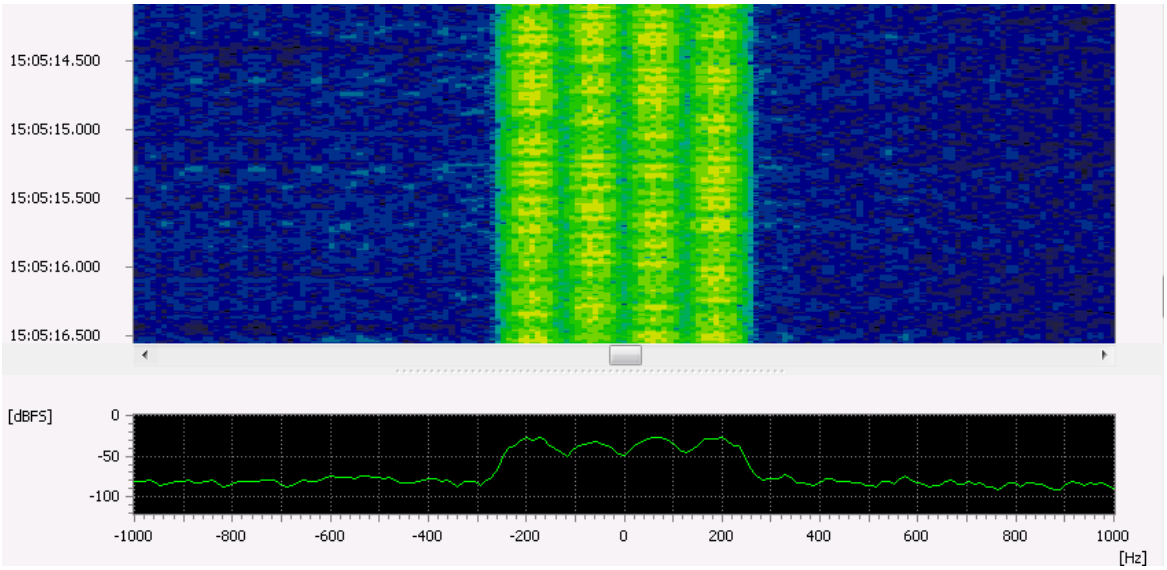


Figure 105: Clover-II Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Clover II
Modulation order	4
Min. burst length (s)	0.540
Max. burst length (s)	17.824
Min. pause length (s)	0.064
Min. burst SNR (dB)	0
VER file name	*clover_II.ver*

Table 107: Clover-II Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 108: Clover-II Features

Clover 2000

General Information

Clover 2000 mode is a standard developed by HAL Communications Corp., USA.
Clover 2500 is a version with identical modulation types and coding but increased bandwidth (2500 Hz) and symbol-rate.

Usage:

- ARQ and broadcast data communication over HF.

Mode Properties

Parameter	Value	
Modulation	DBPSK, DQPSK, 8-DPSK, 8P2A, 16P4A	
Number of channels	8	
Channel spacing (Hz)	250	312.5
Bandwidth (Hz)	2000	2500
Symbol rate (Baud)	62.5	78.125
Coding	Reed-Solomon	

Table 109: Clover 2000 / 2500 Characteristics

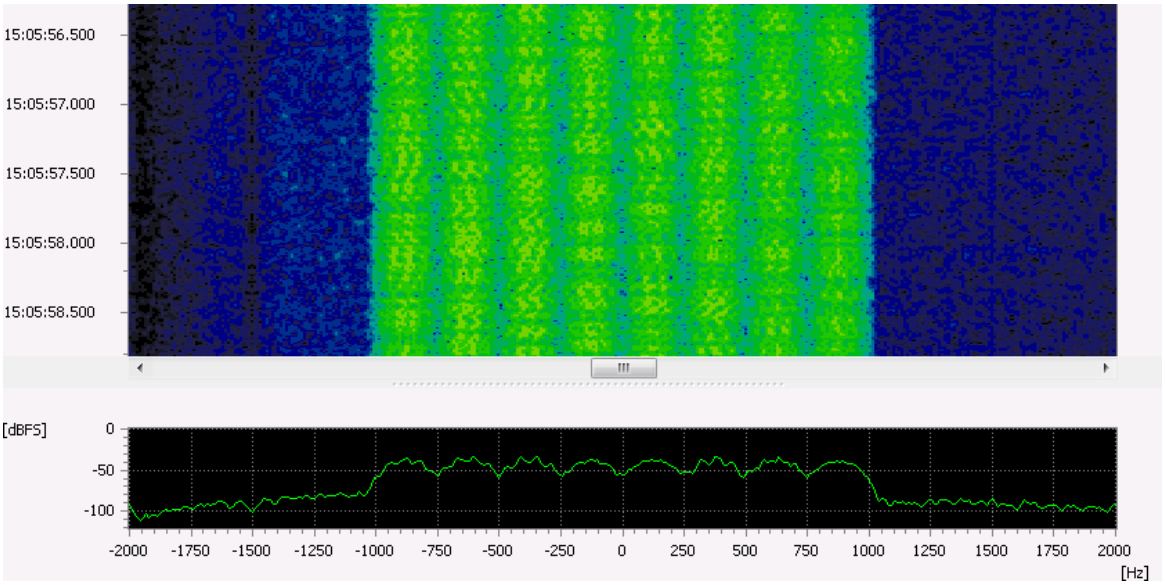


Figure 106: Clover 2000 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Clover 2000
Modulation order	64
Min. burst length (s)	0.270
Max. burst length (s)	4.400
Min. pause length (s)	0.040
Min. burst SNR (dB)	0
VER file name	*clover_2000.ver*

Table 110: Clover 2000 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 111: Clover 2000 / 2500 Features

Codan 3012

General Information

Codan 3012 mode is a proprietary standard developed by CODAN PTY Australia. Codan 3212 is similar to the Codan 3012 mode with same modulation parameters and slightly different encoding parameters. The Codan 3212 modem also supports decoding of the Codan 3012 mode.

Usage:

- ARQ and broadcast data communication over HF.
- ALE.

Mode Properties

Parameter	Value
Modulation	PSK
Number of tones	2
Number of channels	32
Channel spacing (Hz)	80
Bandwidth (Hz)	2560
Symbol rate (Bd)	80
Coding	Golay code

Table 112: Codan 3012 ALE Characteristics

Parameter	Value
TX modus	selective, broadcast, group call
Modulation	DPSK
Number of tones	4
Number of channels	4,8,12,16
Channel spacing (Hz)	112.5
Bandwidth (Hz)	1800
Symbol rate (Bd)	1200
Data rate (bit/s)	up to 6000
Alphabet	CCIR-476

Table 113: Codan 3012 Data Characteristics

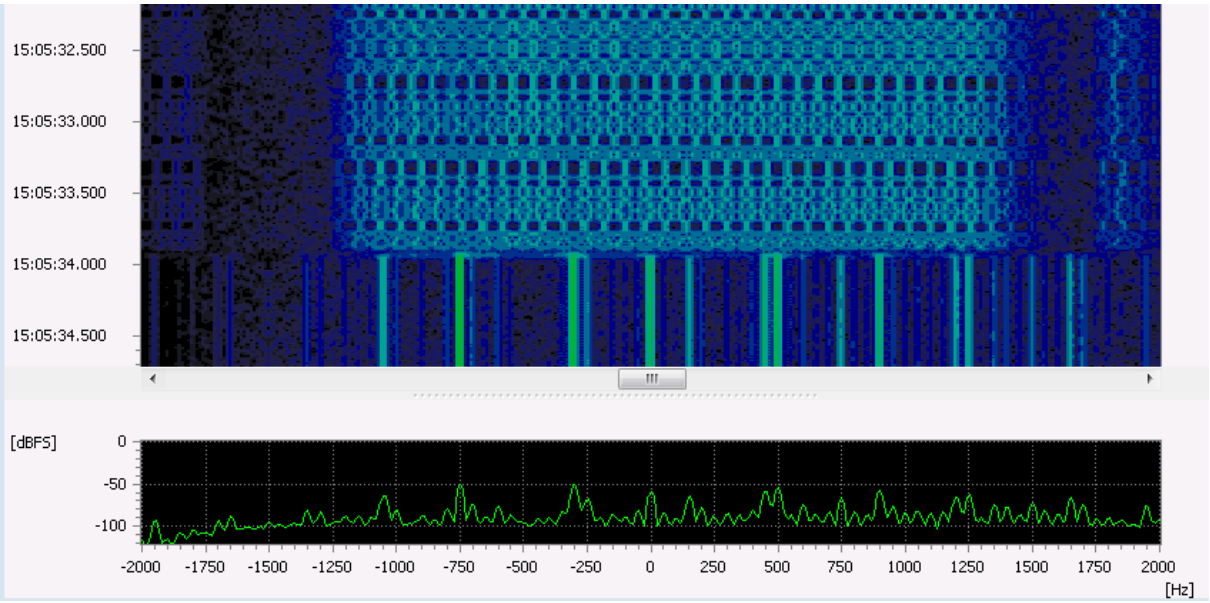


Figure 107: Codan 3012 ALE Spectrogram

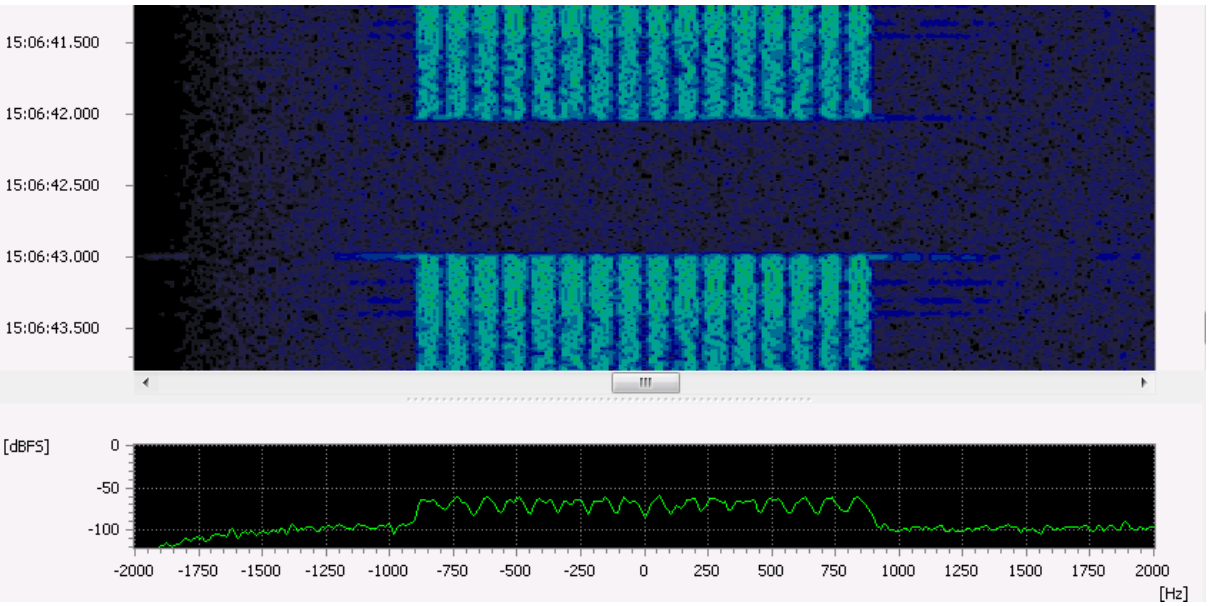


Figure 108: Codan 3012 Data Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	MDPSK 2,4,8,16 A/B
Symbol rate (Bd)	80
SR tolerance (Bd)	5
Modulation order	2
Version	A
No. of channels	32
Channel position type	Channel distance
Channel distance (Hz)	80

Parameter	Default
VER file name	*codanchirp.ver*

Table 114: Codan 3012 ALE Demodulator Settings

Parameter	Default
Demodulator	MDPSK 2,4,8,16 A/B
Symbol rate (Bd)	75
SR tolerance (Bd)	2
Modulation order	4
Version	A
No. of channels	16
Channel position type	Channel distance
Channel distance (Hz)	112.5
Min. burst length (s)	0.700
Max. burst length (s)	12.000
Min. pause length (s)	0.070
Min. burst SNR (dB)	9
VER file name	*codan3212_16channel_psk.ver*

Table 115: Codan 3012 Data Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 116: Codan 3012 Features

Codan Selcal

General Information

Codan SelCall FSK is a radio standard developed by CODAN PTY Australia.

Usage:

- Selcall and status message transfer over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2

Parameter	Value
Shift (Hz)	200
Bandwidth (Hz)	400
Symbol rate (Bd)	100
Coding	Parity checksum

Table 117: Codan Selcal ALE Characteristics

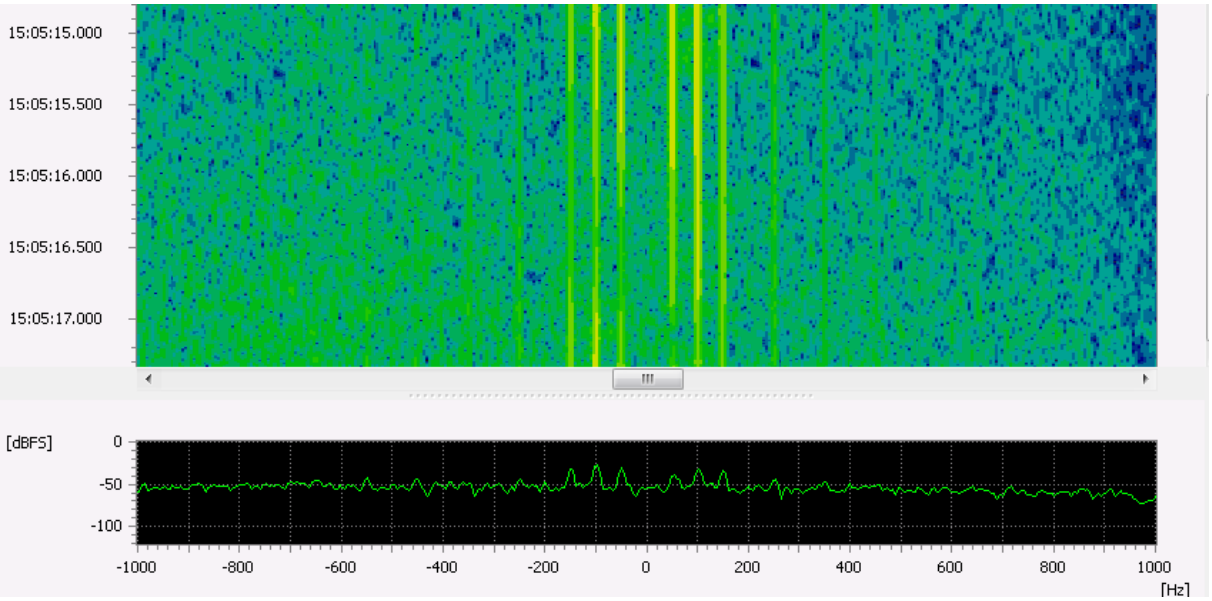


Figure 109: Codan Selcal Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	200
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*codan_selcall.ver*

Table 118: Codan Selcal Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes

Feature	Status
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 119: Codan Selcal Features

Coquelet-8

General Information

The Coquelet modes were designed for the communications of French customs and police authorities. They are similar to the British Piccolo modes.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	8
Shift (Hz)	26.67
Bandwidth (Hz)	300
Symbol rate (Baud)	13.3 / 26.7
Alphabet	ITA-2 / ATU-80

Table 120: Coquelet-8 Characteristics

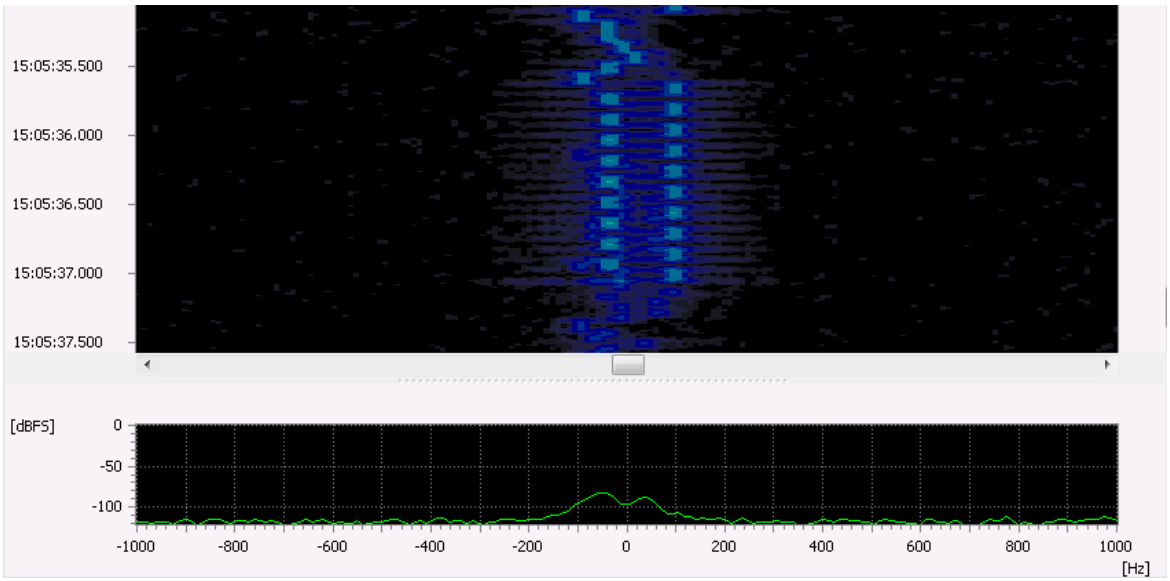


Figure 110: Coquelet-8 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Coquelet
Tone duration (ms)	37.5

Parameter	Default
TD tolerance (ms)	2
No. of tones	8
Tone distance (Hz)	26.67
VER file name	*coquelet-8.ver*

Table 121: Coquelet-8 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 122: Coquelet-8 Features

Coquelet-13

General Information

The Coquelet modes were designed for the communications of French customs and police authorities. They are similar to the British Piccolo modes.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	MFSK
Number of tones	13
Shift (Hz)	30
Bandwidth (Hz)	500
Symbol rate (Baud)	13.3 / 20.0
Alphabet	ITA-2 / ATU-80

Table 123: Coquelet-13 Characteristics

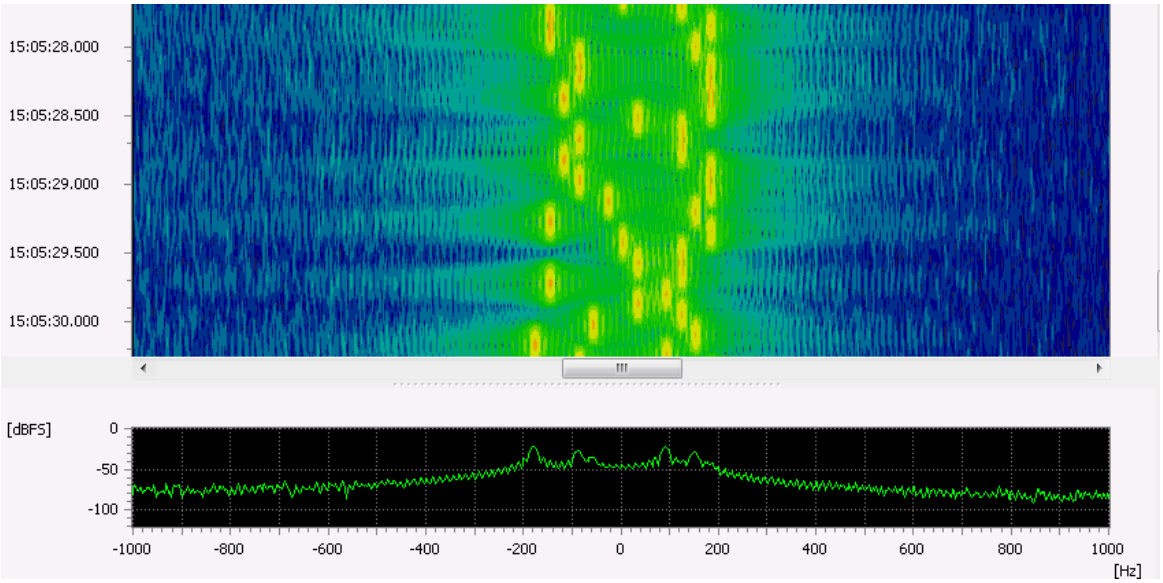


Figure 111: Coquelet-13 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	75
TD tolerance (ms)	1
No. of tones	13
Tone position type	Equidistant frequencies
Tone distance (Hz)	30
VER file name	*coquelet-13_75ms.ver*

Table 124: Coquelet-13 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 125: Coquelet-13 Features

Coquelet-80

General Information

The Coquelet modes were designed for the communications of French customs and police authorities. They are similar to the British Piccolo modes.
Coquelet-80 is the extension of Coquelet-8 by FEC.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	8
Shift (Hz)	26.67
Bandwidth (Hz)	300
Symbol rate (Baud)	13.3 / 26.7
Alphabet	ITA-2 / ATU-80

Table 126: Coquelet-80 Characteristics

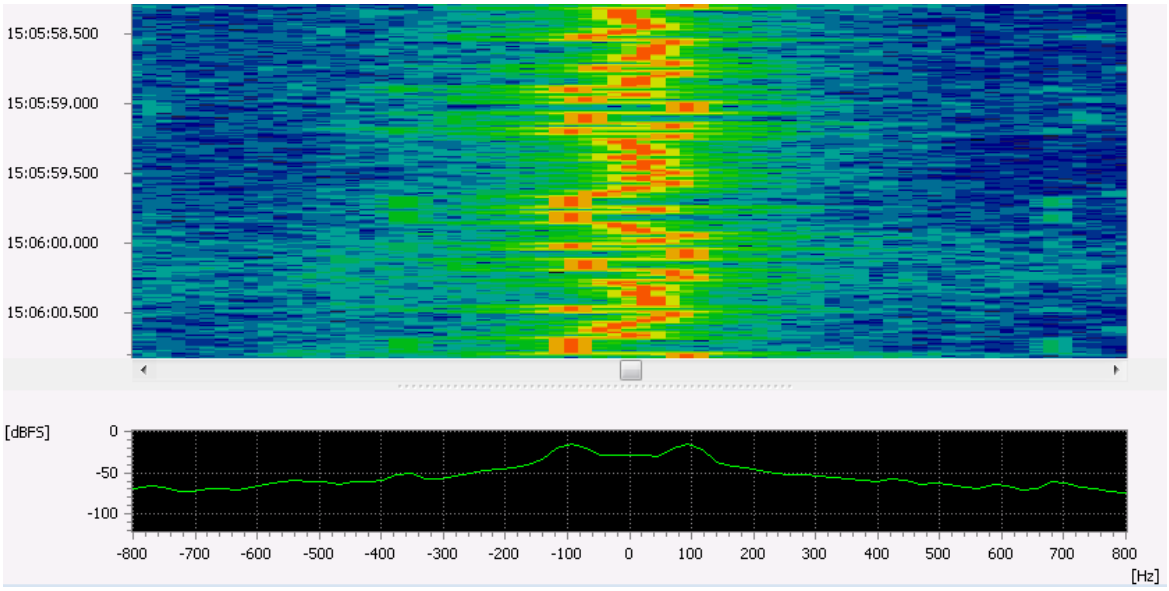


Figure 112: Coquelet-80 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Coquelet
Tone duration (ms)	37.5
TD tolerance (ms)	2
No. of tones	8
Tone spacing (Hz)	26.67
VER file name	*coquelet-80.ver*

Table 127: Coquelet-80 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 128: Coquelet-80 Features

DGPS

General Information

DGPS is a radio standard for transmission of corrections to the satellite ranging measurements (GPS and GLONASS). This radio standard is based on the recommendations of the RTCM Special Committee 104 (SC-104).

Usage:

- Transmission of differential correction signals.

Mode Properties

Parameter	Value
Modulation	MSK / QPSK
Symbol rate (Baud)	100 / 300
Coding	Parity checksum, CRC

Table 129: DGPS Characteristics

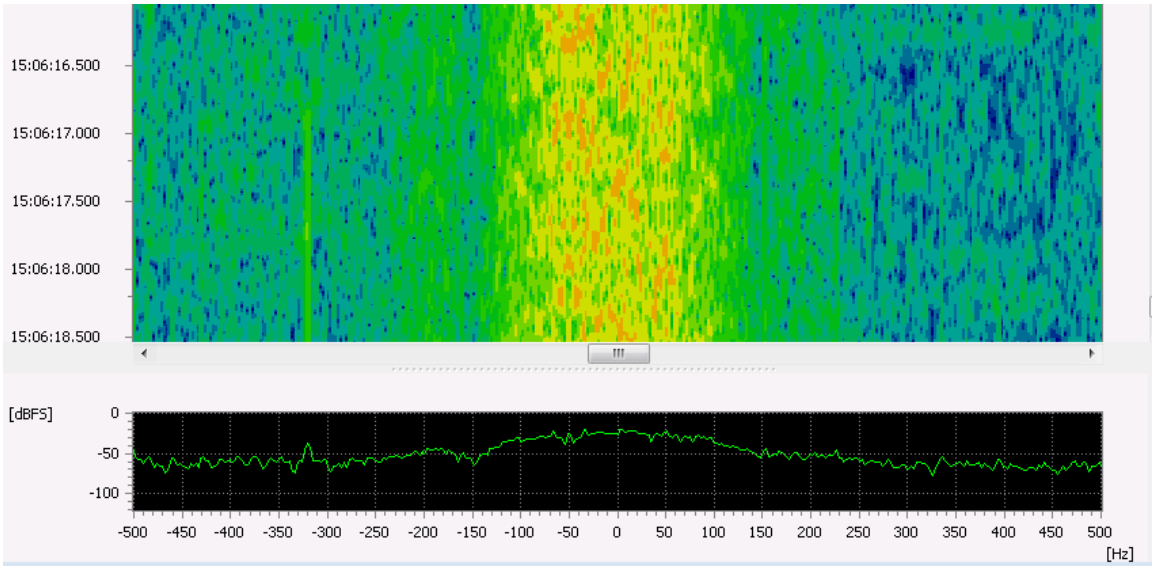


Figure 113: DGPS Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	(G)MSK.
Type	MSK
Symbol rate (Bd)	200
SR tolerance (Bd)	10
VER file name	*dgps_200bd_msk.ver*

Table 130: DGPS Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 131: DGPS Features

DSC

General Information

DSC (**D**igital **S**elective **C**alling) is part of the GMDSS (Global Maritime Distress and Safety System). It provides automatically formatted distress alerts, urgency, safety and routine radio-telephone calls.

Usage:

- Data communication over HF / VHF.
- Initiation of radiotelephone and MF/HF radiotelex calls.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	500
Symbol rate (Baud)	100
Coding	Checksum

Table 132: DSC HF Characteristics

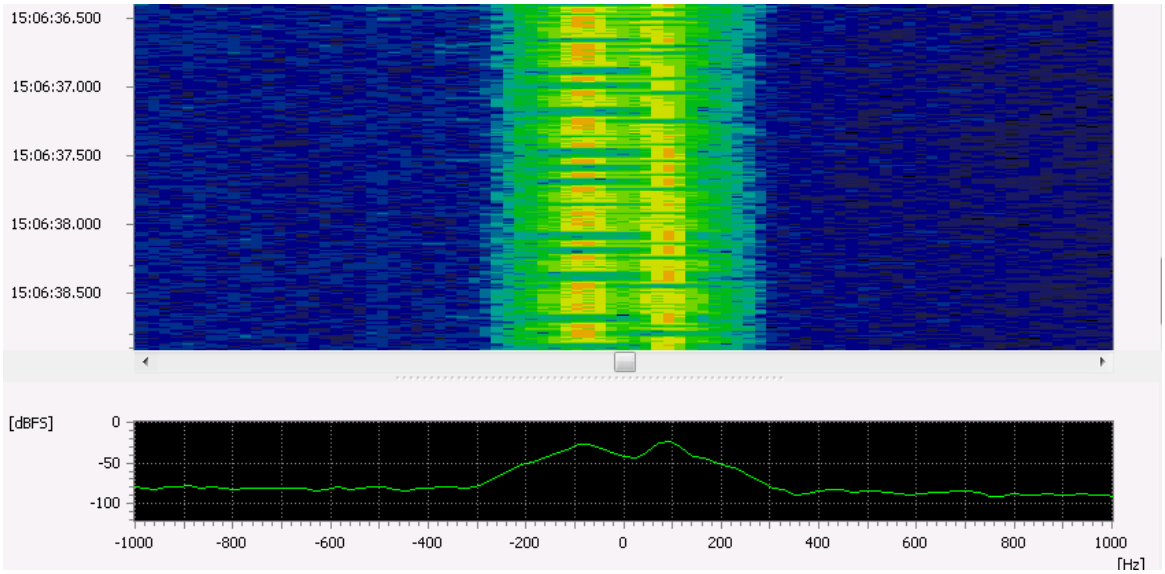


Figure 114: DSC HF Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	10
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*dsc-hf.ver*

Table 133: DSC HF Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment HF	no
Combination with other modems (modem list)	yes

Table 134: DSC Features

DUP-ARQ

General Information

DUP-ARQ is a synchronous duplex teleprinter system with ARQ. This modem was used by the Ministry of Foreign Affairs in Hungary.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Symbol rate (Baud)	125
Coding	7 bit parity
Alphabet	ITA-2

Table 135: DUP-ARQ Characteristics

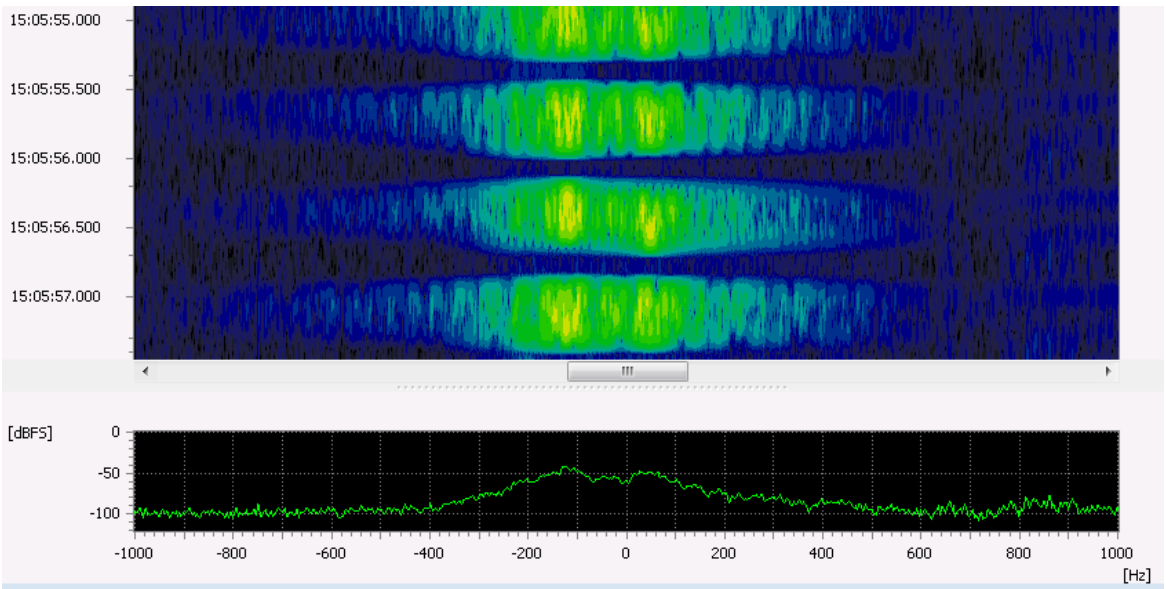


Figure 115: DUP-ARQ Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	125
SR tolerance (Bd)	0.1
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.245

Parameter	Default
Max. burst length (s)	0.280
Min. pause length (s)	0.260
VER file name	*dup-arq_125bd_170hz.ver*

Table 136: DUP-ARQ Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 137: DUP-ARQ Features

FEC-A

General Information

FEC-A is a synchronous FEC system. This system was mainly used for military and diplomatic services as well as for news agencies.
This modem system is also known as FEC-100(A).

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	850
Bandwidth (Hz)	1200
Symbol rate (Baud)	144
Error correction	Convolutional coding
Alphabet	ITA-2

Table 138: FEC-A Characteristics

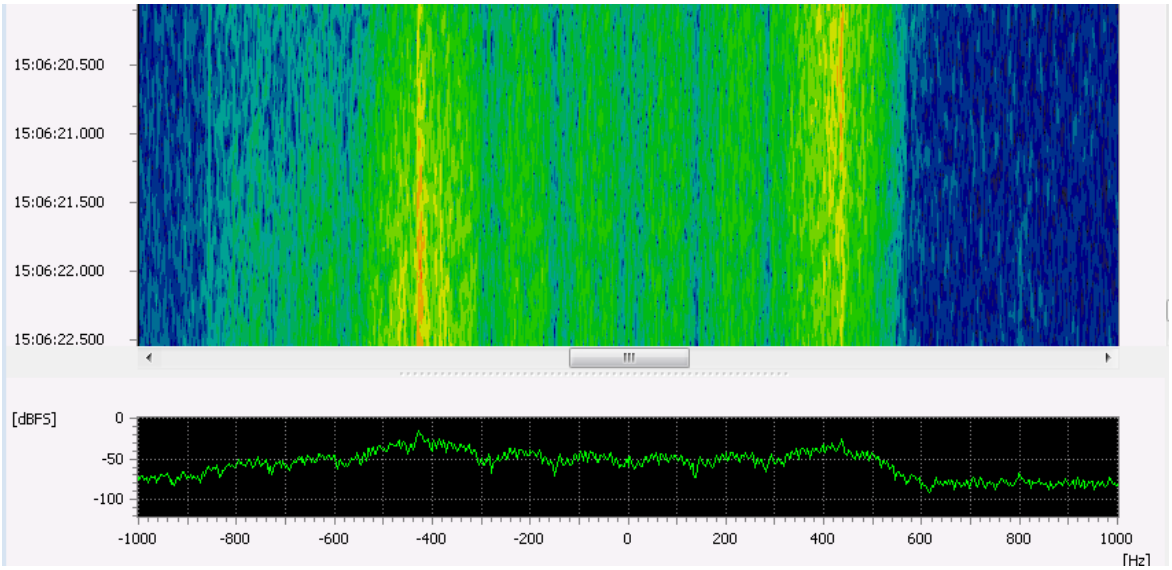


Figure 116: FEC-A Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	145
SR tolerance (Bd)	5
Shift (Hz)	850
Shift tolerance (Hz)	50
Modem type	Synchronous
VER file name	*fec-a_145bd_850hz.ver*

Table 139: FEC-A Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 140: FEC-A Features

FSK 400/500

General Information

FSK 400/500 is a chinese multi-tone modem.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	MFSK
Number of tones	4
Tone spacing (Hz)	400 / 500
Bandwidth (Hz)	500 / 600
Symbol rate (Bd)	100

Table 141: FSK 400/500 Characteristics

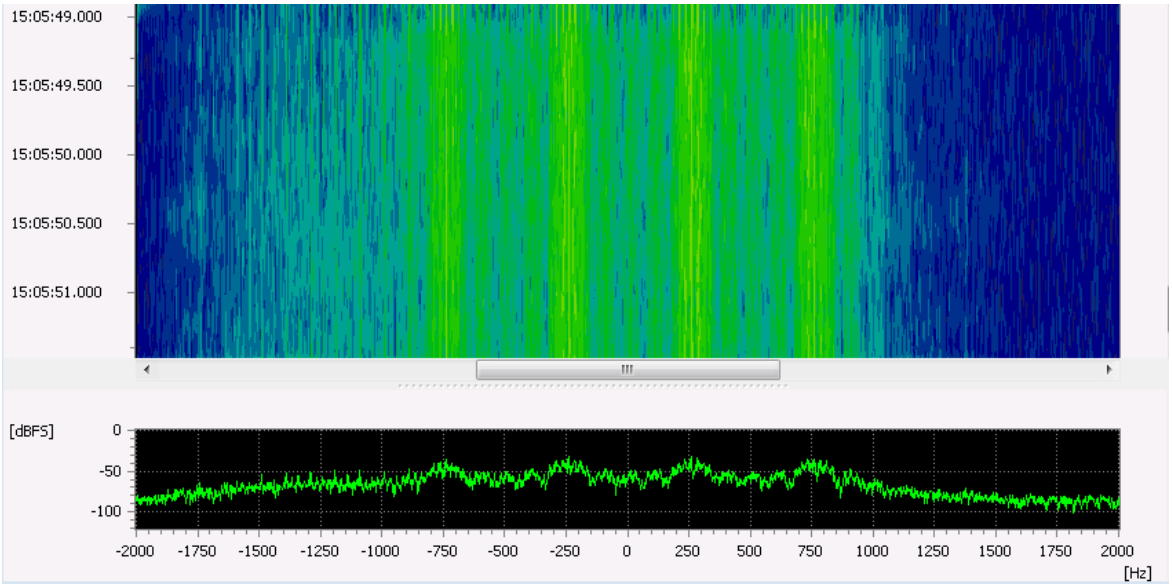


Figure 117: FSK 400/500 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	10
TD tolerance (ms)	0.5
No. of tones	4
Tone position type	Equidistant frequencies
Tone distance (Hz)	500
Min. burst length (s)	2.500
Max. burst length (s)	3.200
Min. pause length (s)	1.000
VER file name	*fsk_400_500.ver*

Table 142: FSK 400/500 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 143: FSK 400/500 Features

Globe Wireless FSK

General Information

Globe Wireless FSK is one of several radio modems used by the Globe Wireless company in the HF-frequency band.

Usage:

- Transfer of selcall and status messages over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	300
Symbol rate (Bd)	100
Error correction	Parity checksum

Table 144: Globe Wireless FSK Characteristics

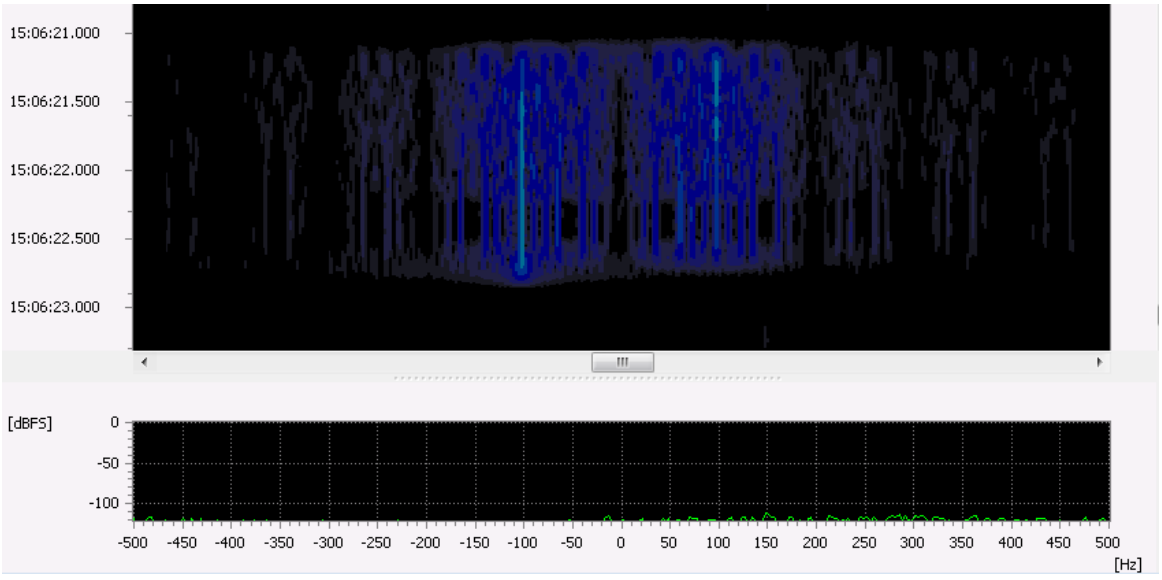


Figure 118: Globe Wireless FSK Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	10
Shift (Hz)	200
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.700
Max. burst length (s)	1.700
Min. pause length (s)	0.120
VER file name	*gw_fsk_100bd_200hz.ver*

Table 145: Globe Wireless FSK Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 146: Globe Wireless FSK Features

Globe Wireless PSK

General Information

Globe Wireless PSK is one of several radio modems used by the Globe Wireless company in the HF-frequency band.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	DQPSK
Bandwidth (Hz)	400
Symbol rate (Bd)	200

Table 147: Globe Wireless PSK Characteristics

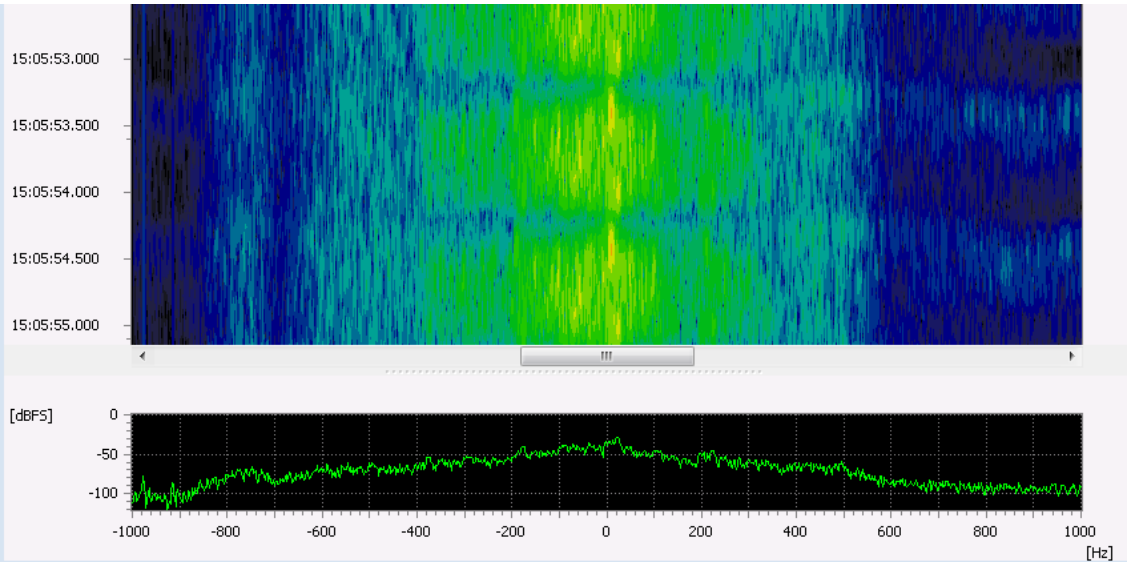


Figure 119: Globe Wireless PSK Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8,16 A/B
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Modulation order	4
Version	A
Min. burst length (s)	0.400
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	0
VER file name	*gw_psk_200bd_psk4.ver*

Table 148: Globe Wireless PSK Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 149: Globe Wireless PSK Features

G-TOR

General Information

G-TOR mode is a proprietary standard developed by Kantronics Inc. and is used by radio amateurs, military (Irish Air Corps/Navy, Mexican army) and governmental agencies (ICRC).

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Symbol rate (Bd)	100 / 200 / 300
Coding	Golay code, Interleaving, CRC
Alphabet	ITA-5

Table 150: G-TOR Characteristics

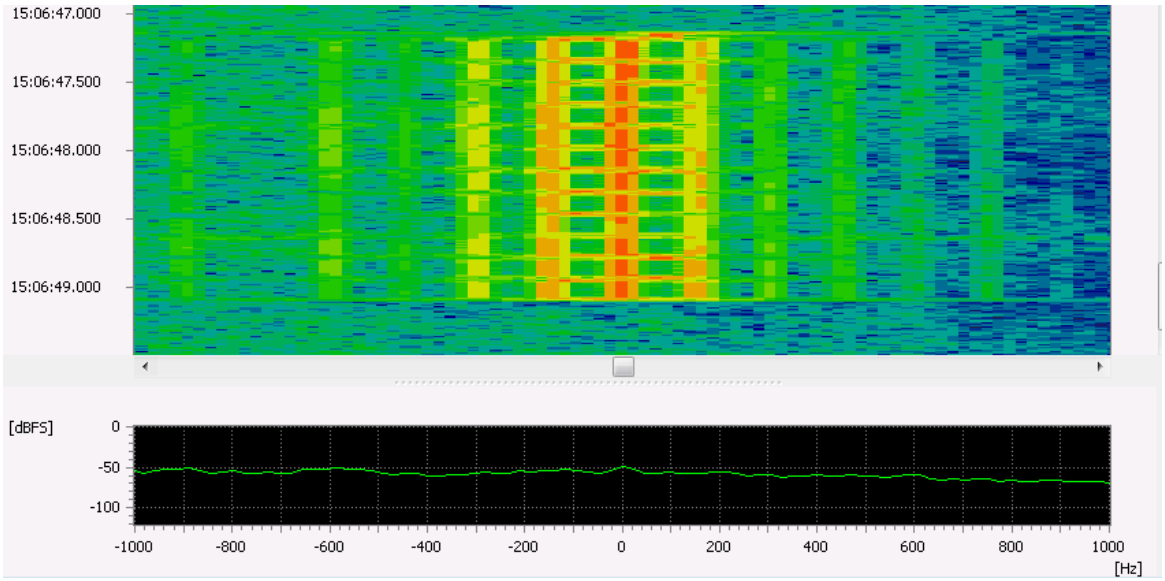


Figure 120: G-TOR Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	300
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	180
Shift tolerance (Hz)	20
Modem type	Synchronous
Min. burst length (s)	0.080

Parameter	Default
Max. burst length (s)	2.000
Min. pause length (s)	0.080
VER file name	g-tor_300bd_180hz.ver

Table 151: G-TOR Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 152: G-TOR Features

HFDL

General Information

The High Frequency Data Link HFDL (ARINC Report 635-3) is used in civil long distance aircraft communications between aircrafts and a cluster of ground stations.

Usage:

- Aeronautical information exchange over HF.

Mode Properties

Parameter	Value
Modulation	PSK2/4/8
Bandwidth (Hz)	400
Symbol rate (Bd)	1800
Error correction	ARQ
Data rate (bps)	300 / 600 / 1200 /1800

Table 153: HFDL Characteristics

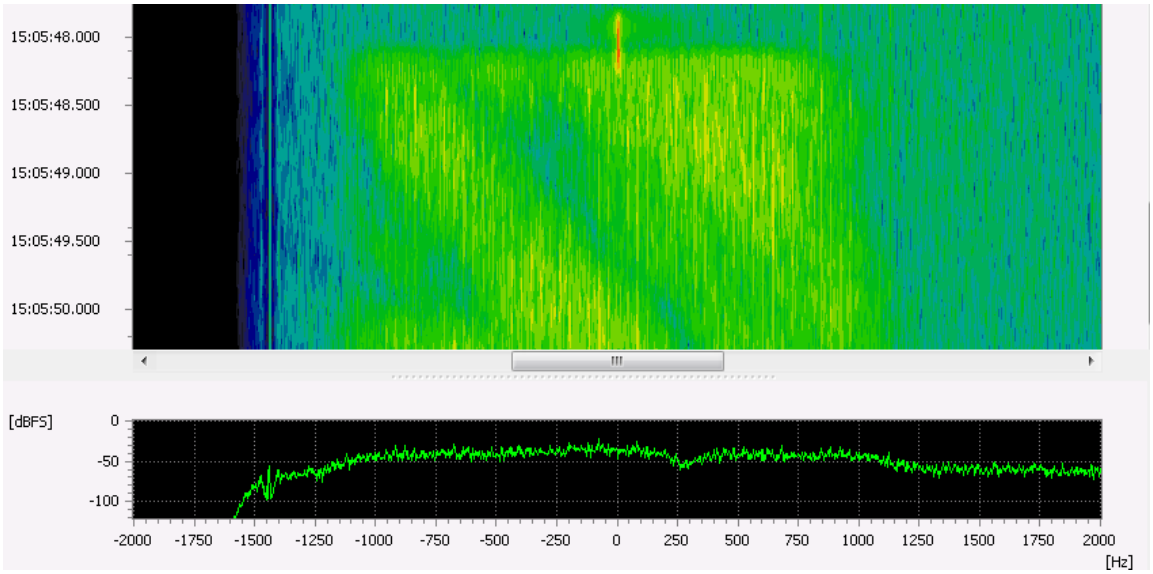


Figure 121: HFDL Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	PSK data added
Symbol rate (Bd)	1800
SR tolerance (Bd)	9
Modulation order	2
Shift (Hz)	170
Min. burst length (s)	2.100
Max. burst length (s)	5.000
Min. pause length (s)	0.010
VER file name	hfdl_psk2.ver

Table 154: HFDL Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	no
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 155: HFDL Features

HNG-FEC

General Information

HNG-FEC is a full duplex system used by the Ministry of Foreign Affairs in Hungary.
This modem is not used any more.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Symbol rate (Bd)	100.5
Coding	Interleaving, Parity bits
Alphabet	ITA-2

Table 156: HNG-FEC Characteristics

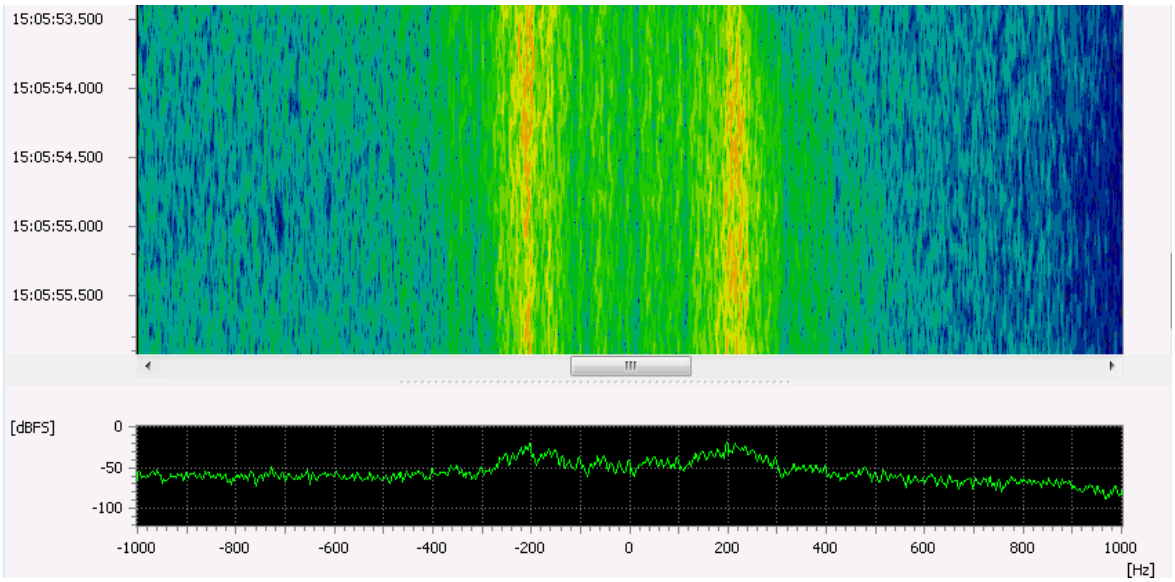


Figure 122: HNG-FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	420
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*hng_fec.ver*

Table 157: HNG-FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 158: HNG-FEC Features

MD674

General Information

MD674 is a military asynchronous FSK modem.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Symbol rate (Bd)	50 … 150
Error correction	ARQ
Alphabet	ITA-2 / ITA-5

Table 159: MD674 Characteristics

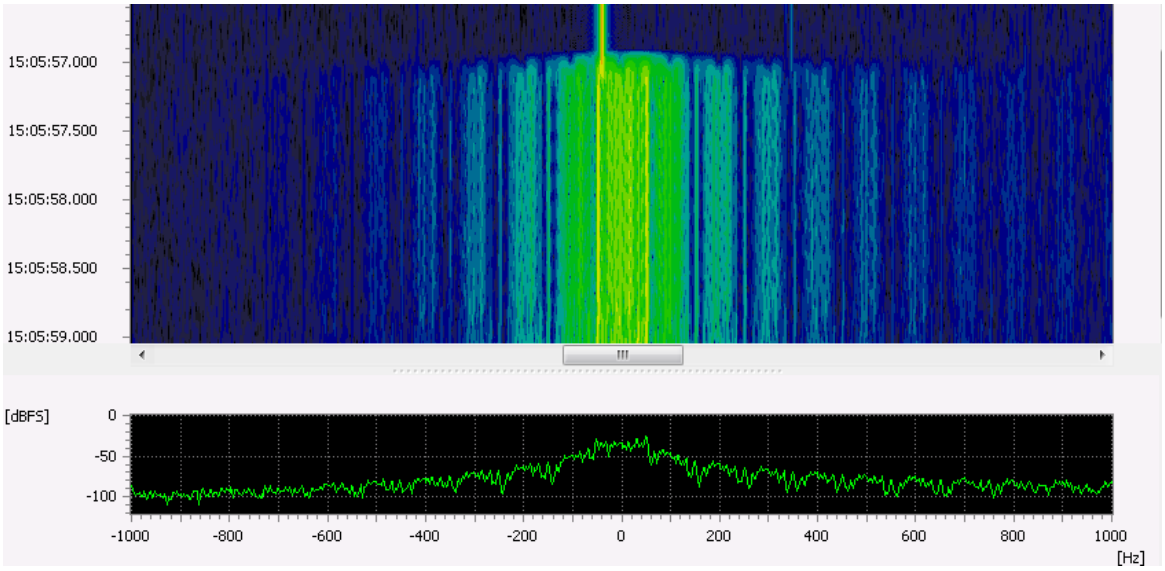


Figure 123: MD674 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	85
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	md647.ver

Table 160: MD674 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 161: MD674 Features

MEROD

General Information

MEROD is a Message Entry and Read-Out Device for exchange of encrypted tactical messages over a radio channel in burst mode.

Usage:

- Exchange of tactical information over HF with emissions of minimum length.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	810
Bandwidth (Hz)	1200
Symbol rate (Bd)	266
Error correction	BCH(127,78)
Alphabet	MEROD specific 6 bit

Table 162: MEROD Characteristics

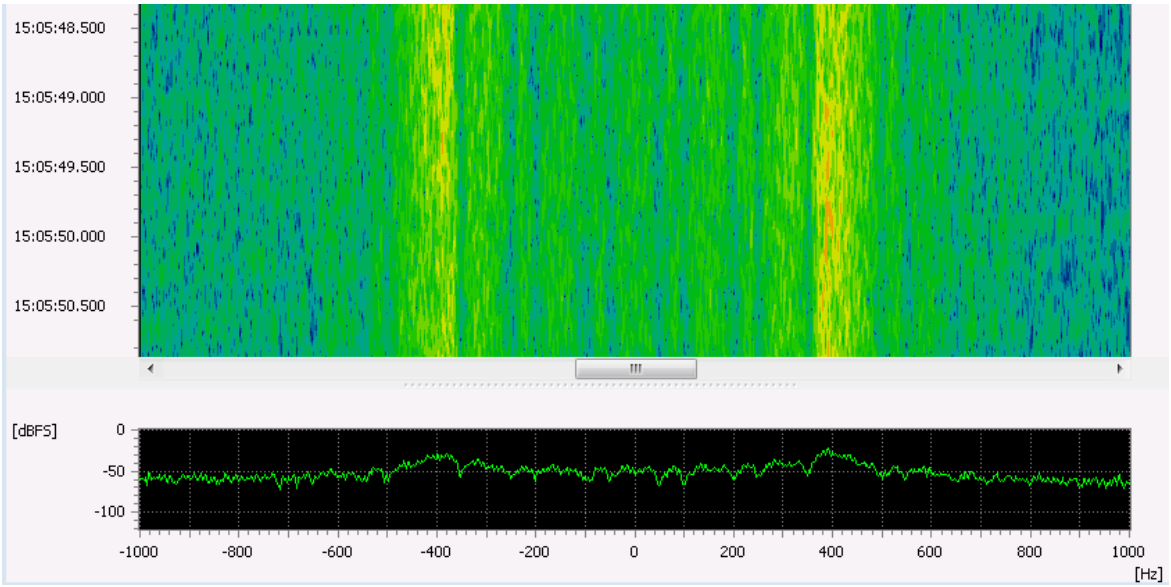


Figure 124: MEROD Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	150
SR tolerance (Bd)	5
Shift (Hz)	810
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*merod.ver*

Table 163: MEROD Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 164: MEROD Features

MFSK8

General Information

MFSK8 is a mode for digital data communication in the amateur radio domain.

Usage:

- Transfer of textual information by radio amateurs over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	32
Tone spacing (Hz)	7.8125
Bandwidth (Hz)	330
Symbol rate (Bd)	7.8125
Error correction	FEC

Table 165: MFSK8 Characteristics

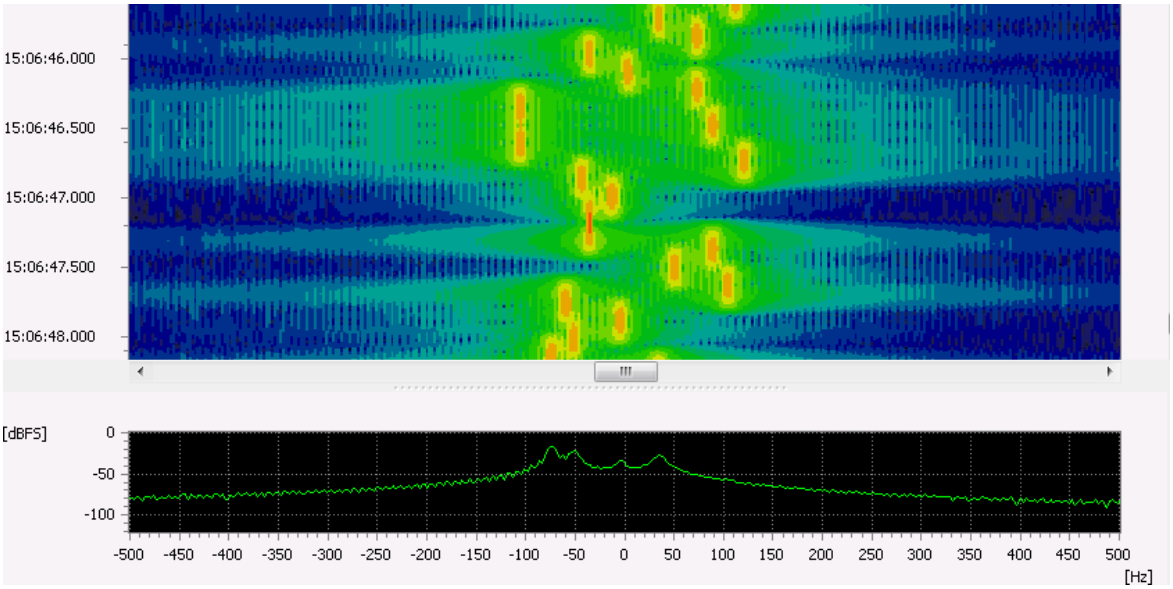


Figure 125: MFSK8 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	128
TD tolerance (ms)	0
No. of tones	32
Tone position type	Equidistant frequencies
Tone distance (Hz)	7.813
VER file name	mfsk-8.ver

Table 166: MFSK8 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 167: MFSK8 Features

MFSK16

General Information

MFSK16 is a mode for digital data communication in the amateur radio domain.

Usage:

- Transfer of textual information by radio amateurs over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	16
Tone spacing (Hz)	15.625
Bandwidth (Hz)	330
Symbol rate (Bd)	15.625
Error correction	FEC

Table 168: MFSK16 Characteristics

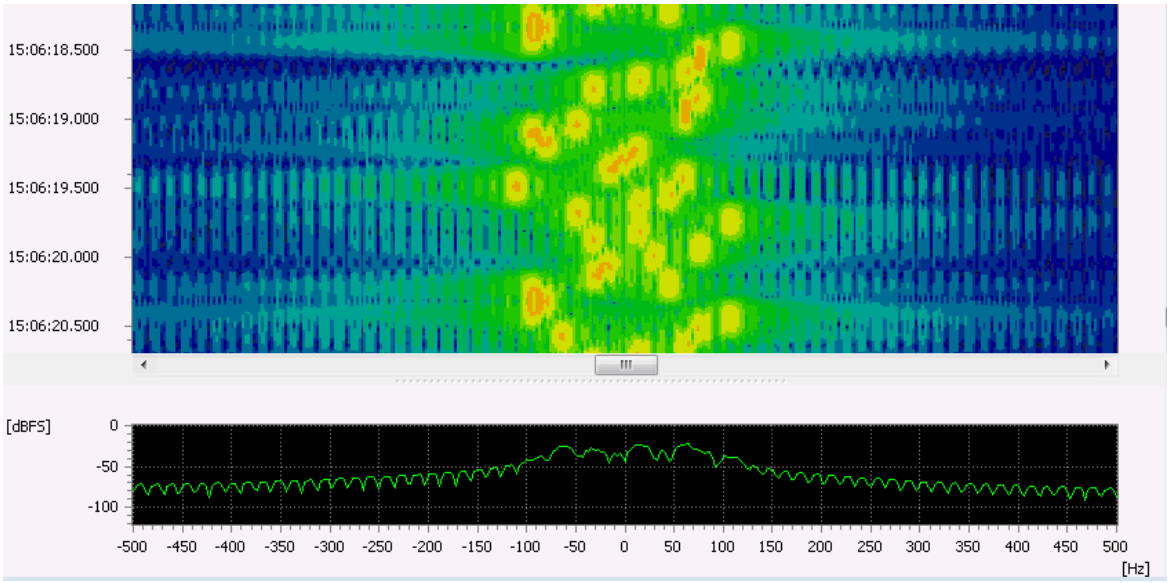


Figure 126: MFSK16 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	64
TD tolerance (ms)	0.3
No. of tones	16
Tone position type	Equidistant frequencies
Tone distance (Hz)	15.625
VER file name	*mfsk-16.ver*

Table 169: MFSK16 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 170: MFSK16 Features

Morse

General Information

Morse code was the first method for data transfer over radio. By now it has been mostly replaced by digital modes.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	Carrier keyed on/off
Bandwidth (Hz)	400
Symbol rate (Bd)	Depending on data-rate
Data rate (cpm)	30 … 300

Table 171: Morse Characteristics

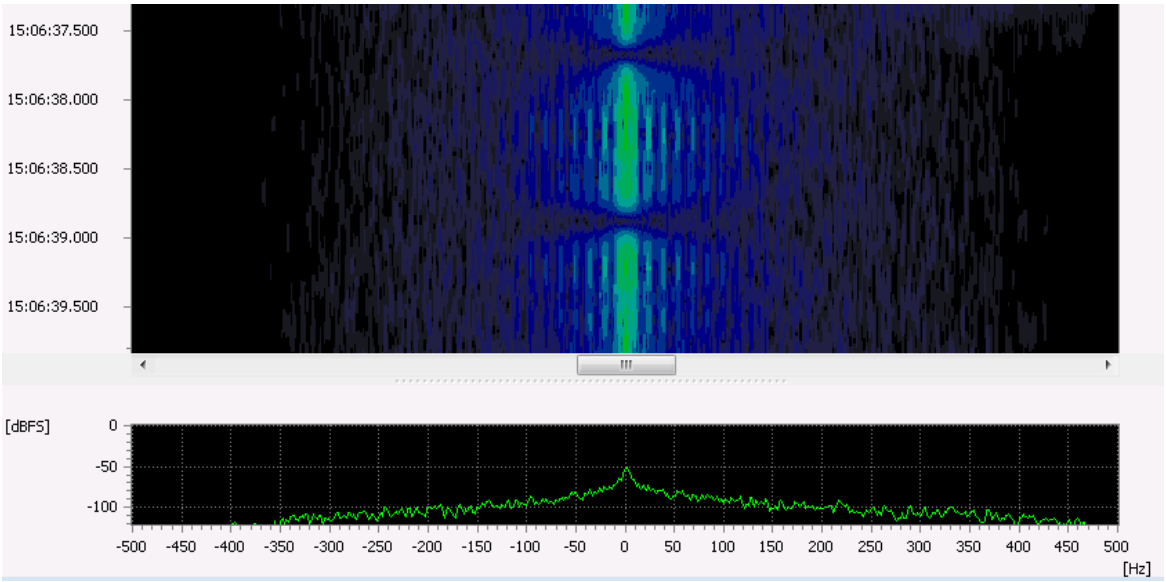


Figure 127: Morse Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Morse
Range (cpm)	60…125
Keying rate (cpm)	250
Tolerance (cpm)	250
VER file name	morse_raw.ver

Table 172: Morse Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 173: Morse Features

Olivia

General Information

Olivia is a radio teletype modem developed by radio amateur Pawel Jalocha.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	MFSK
Number of tones	4/8/16/32
Shift (Hz)	200
Symbol rate (Bd)	31.25
Coding	Walsh
Alphabet	ITA-5

Table 174: Olivia Characteristics

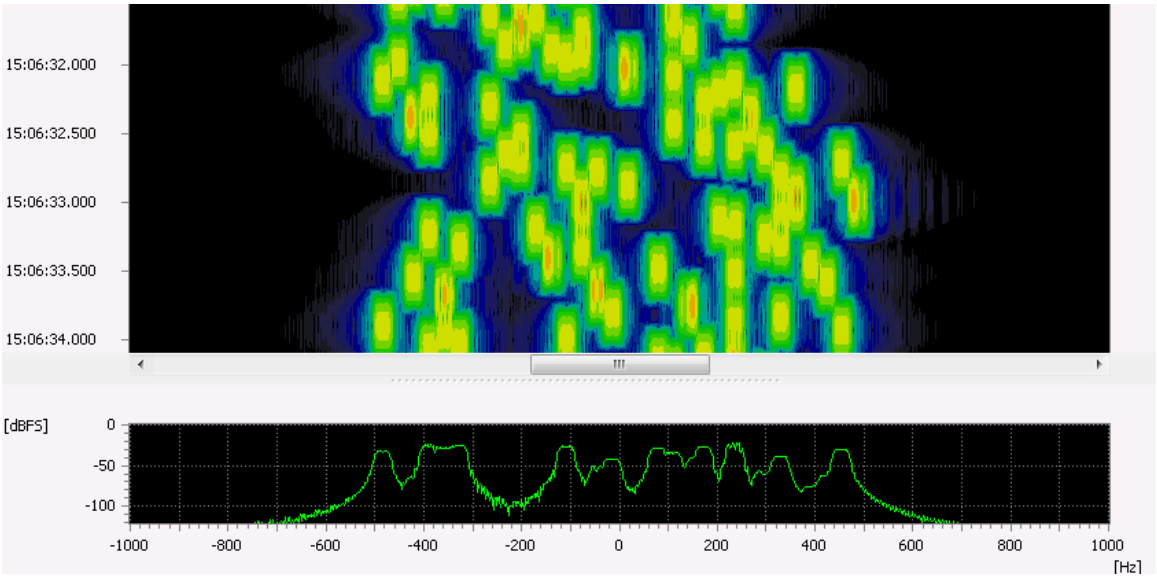


Figure 128: Olivia Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	32
TD tolerance (ms)	4
No. of tones	32
Tone position type	Equidistant frequencies
Tone distance (Hz)	31.25
VER file name	*olivia-1000-32.ver*

Table 175: Olivia Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes

Feature	Status
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 176: Olivia Features

Packet 300

General Information

Packet radio is a complex data transmission system used by radio amateurs. Packet radio networks use the AX.25 data link layer protocol, derived from the X.25 protocol suite and designed for amateur radio use.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	500
Symbol rate (Bd)	500
Coding	NRZ

Table 177: Packet 300 Characteristics

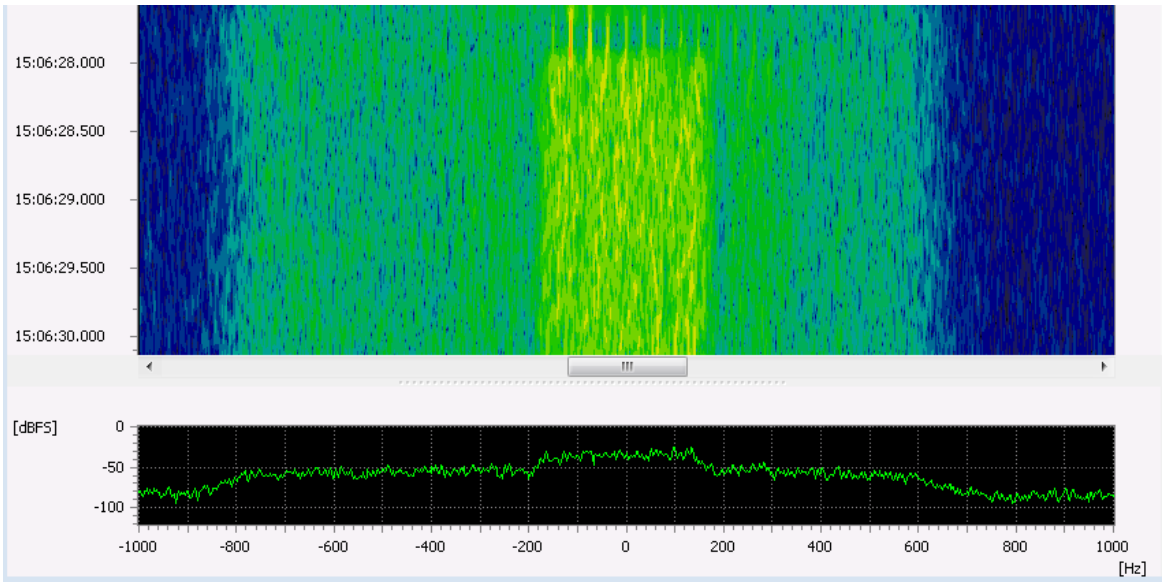


Figure 129: Packet 300 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	300
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	200
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.500
Max. burst length (s)	10.000
Min. pause length (s)	0.180
VER file name	packet-300-4800.ver

Table 178: Packet 300 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 179: Packet 300 Features

PACTOR I

General Information

Pactor-I mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany.

Usage:

- Data communication over HF.
- In successive standards Pactor-II and Pactor-III the mode Pactor-I is used during the call set-up.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	300
Symbol rate (Bd)	100 / 200
Coding	Huffman code

Table 180: PACTOR I Characteristics

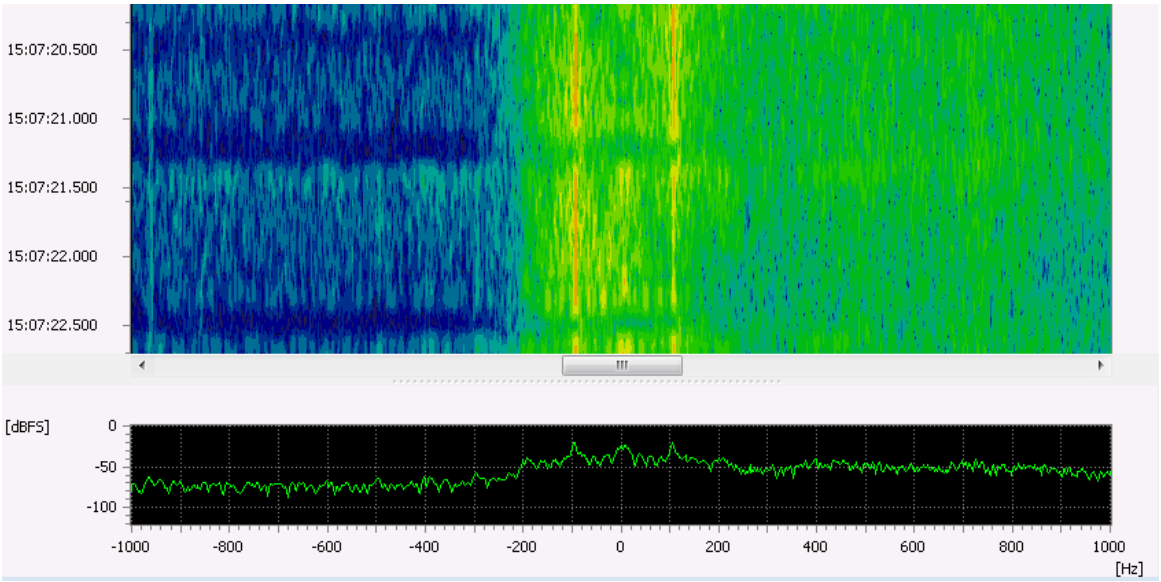


Figure 130: PACTOR I Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Shift (Hz)	200
Shift tolerance (Hz)	10
Modem type	Multiple SR
Min. burst length (s)	0.120
Max. burst length (s)	1.000
Min. pause length (s)	0.170
VER file name	*pactor_i.ver*

Table 181: PACTOR I Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 182: PACTOR I Features

PACTOR I FEC

General Information

Pactor-I mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany.
The FEC/Unproto variant is used for broadcast transmissions.

Usage:

- Broadcast data transmissions over HF.
- During call set-up Pactor-I-FEC mode is used.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Symbol rate (Bd)	100 / 200
Coding	Huffman code, CRC

Table 183: PACTOR I FEC Characteristics

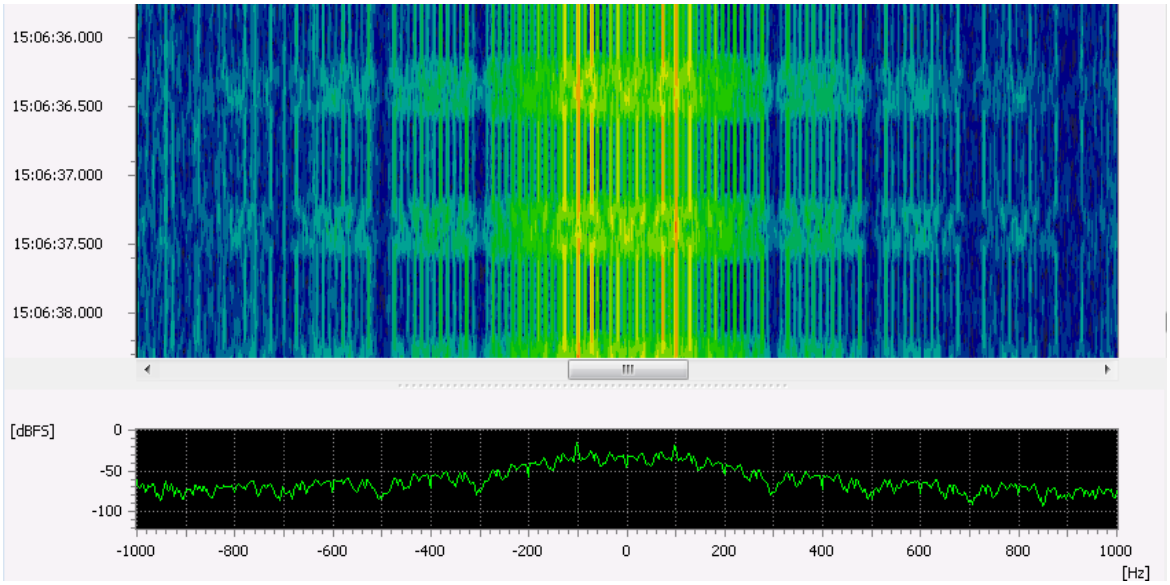


Figure 131: PACTOR I FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	200
SR tolerance (Bd)	1
Shift (Hz)	200
Shift tolerance (Hz)	20
Modem type	Multiple SR
VER file name	*pactor_i_fec.ver*

Table 184: PACTOR I FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 185: PACTOR I FEC Features

PACTOR II

General Information

Pactor-II mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany. It is an advancement of the Pactor-I mode.

Usage:

- ARQ and data communication over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK,DQPSK,8-DPSK,16-DPSK
Number of channels	2
Channel spacing (Hz)	200
Bandwidth (Hz)	450
Symbol rate (Bd)	200
Coding	Convolutional FEC code

Table 186: PACTOR II Characteristics

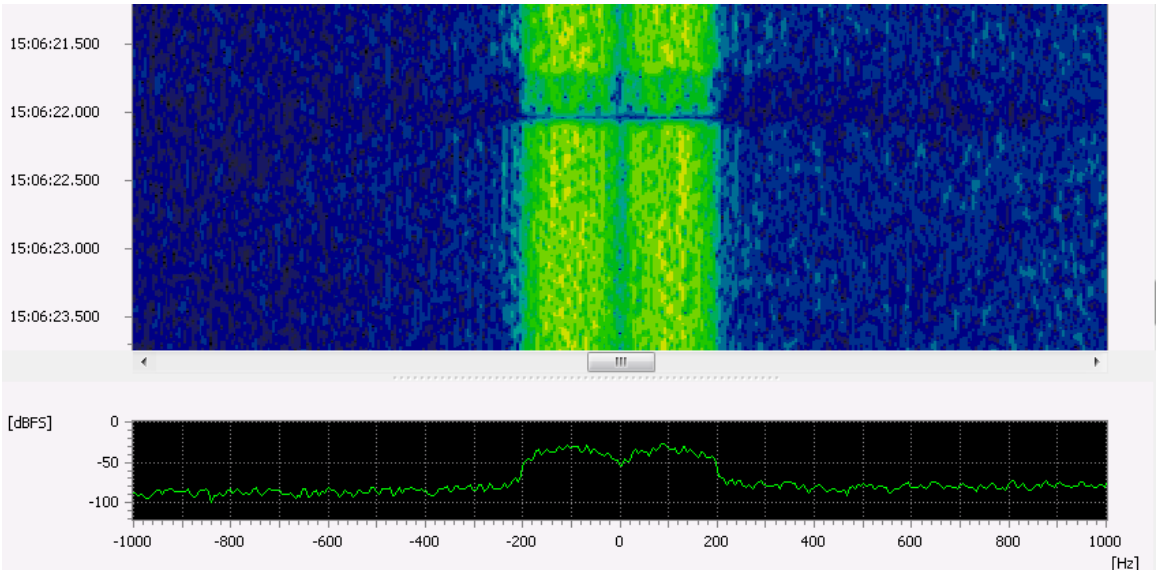


Figure 132: PACTOR II Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Pactor II
Min. burst length (s)	0.300
Max. burst length (s)	3.400
Min. pause length (s)	0.035
Min. burst SNR (dB)	0
VER file name	*pactor_ii.ver*

Table 187: PACTOR II Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 188: PACTOR II Features

PACTOR II FEC

General Information

Pactor-II-FEC mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany. It is an advancement of the Pactor-I-FEC mode.

Usage:

- Broadcast data transmissions (plain-text and encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	DQPSK
Number of channels	2
Channel spacing (Hz)	200
Bandwidth (Hz)	450
Symbol rate (Bd)	200
Coding	Convolutional FEC code, Viterbi code

Table 189: PACTOR II FEC Characteristics

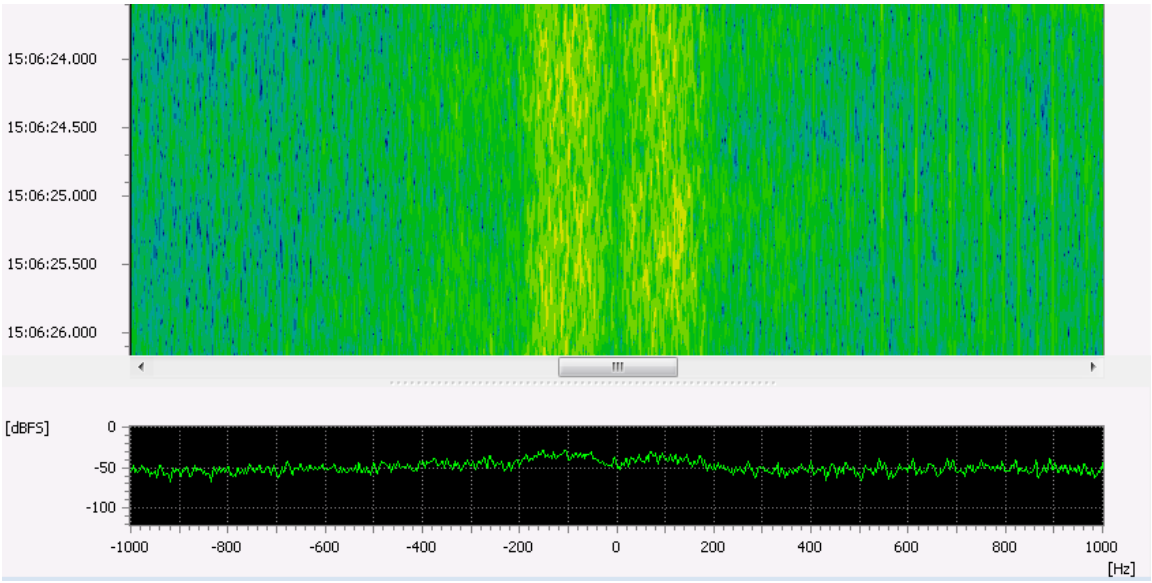


Figure 133: PACTOR II FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Pactor II
VER file name	*pactor_ii_fec.ver*

Table 190: PACTOR II FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes

Feature	Status
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 191: PACTOR II FEC Features

PACTOR III

General Information

Pactor-III mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany. It is an advancement of the Pactor-I and Pactor-II modes.

Usage:

- ARQ and broadcast data communication over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK,DQPSK
Number of channels	2,6,14,16,18
Channel spacing (Hz)	120
Bandwidth (Hz)	max 2200
Symbol rate (Bd)	100 per channel
Coding	Convolutional FEC code

Table 192: PACTOR III Characteristics

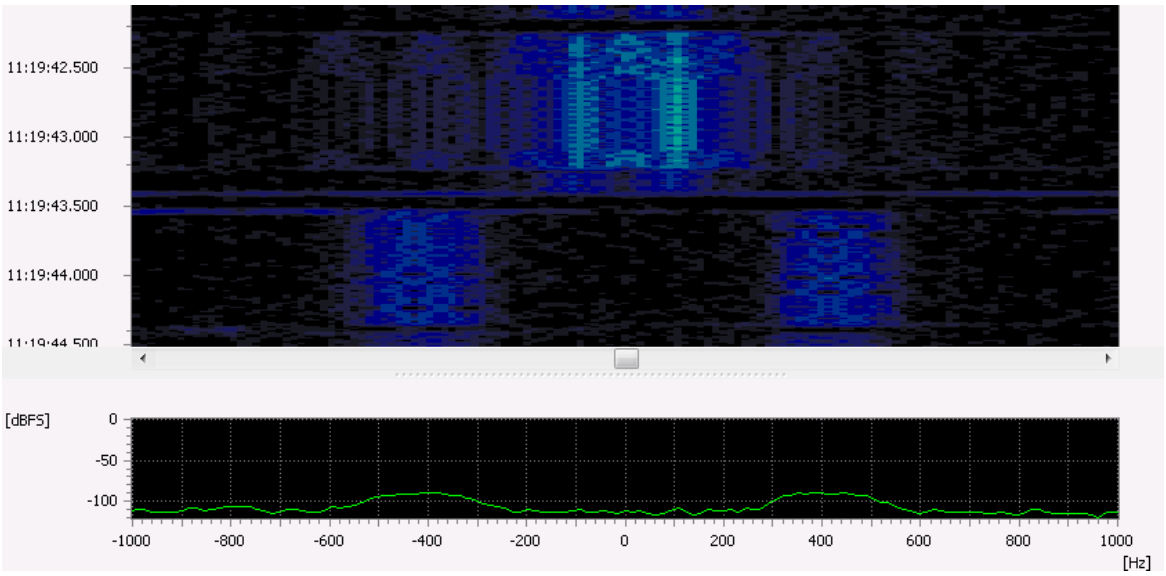


Figure 134: PACTOR III Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Pactor III
Min. burst length (s)	0.300
Max. burst length (s)	3.400

Parameter	Default
Min. pause length (s)	0.035
Min. burst SNR (dB)	0
VER file name	*pactor_iii.ver*

Table 193: PACTOR III Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 194: PACTOR III Features

Piccolo MK6

General Information

The Piccolo modes were developed in the UK for communications between Great Britain and its embassies and military stations all over the world.
They are similar to the French Coquelet modes.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	6
Shift (Hz)	20
Bandwidth (Hz)	180
Symbol rate (Bd)	20
Alphabet	ITA-2

Table 195: Piccolo MK6 Characteristics

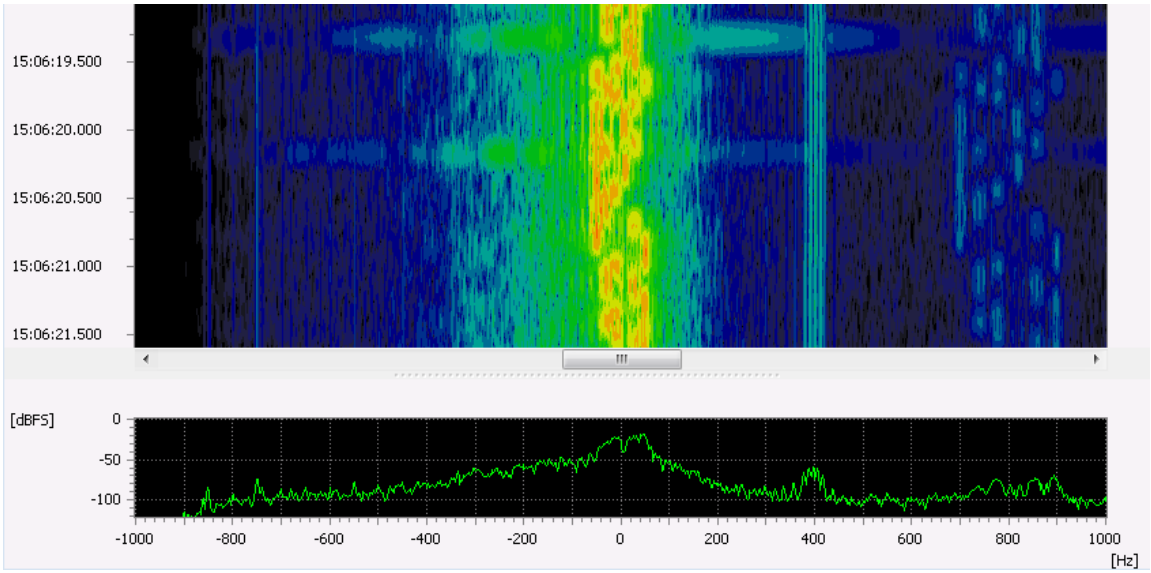


Figure 135: Piccolo MK6 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	50
TD tolerance (ms)	0.1
No. of tones	6
Tone position type	Equidistant frequencies
Tone distance (Hz)	20
VER file name	*piccolo_mk6.ver*

Table 196: Piccolo MK6 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 197: Piccolo MK6 Features

Piccolo MK12

General Information

The Piccolo modes were developed in the UK for communications between Great Britain and its embassies and military stations all over the world.
They are similar to the French Coquelet modes.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	12
Shift (Hz)	20
Bandwidth (Hz)	300
Symbol rate (Bd)	20
Alphabet	ITA-5

Table 198: Piccolo MK12 Characteristics

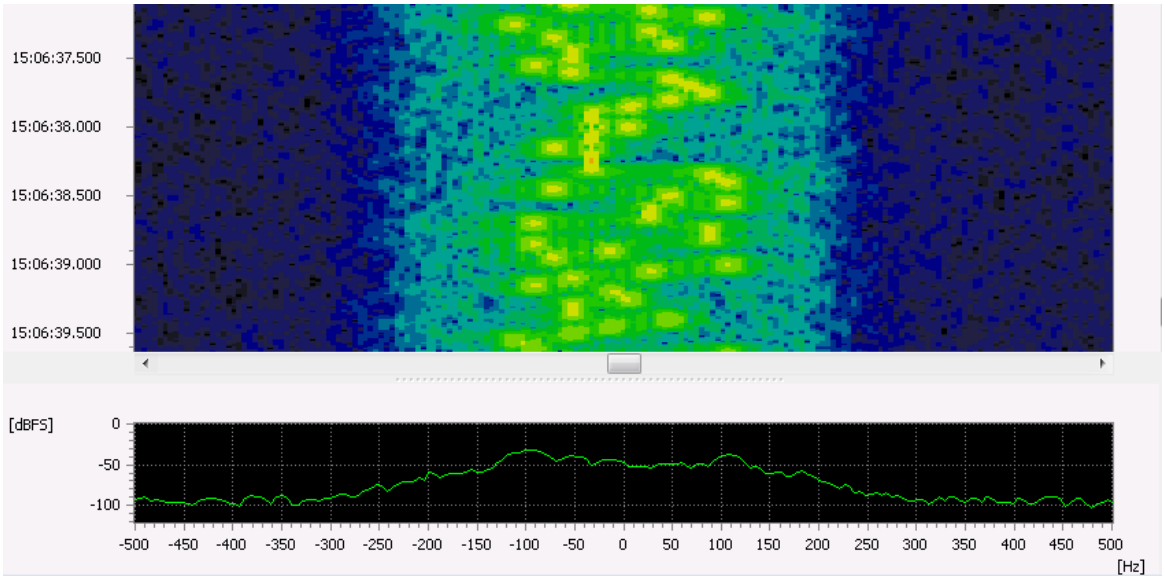


Figure 136: Piccolo MK12 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	50
TD tolerance (ms)	2
No. of tones	12
Tone position type	Equidistant frequencies
Tone distance (Hz)	20
VER file name	*piccolo_mk12.ver*

Table 199: Piccolo MK12 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 200: Piccolo MK12 Features

POL-ARQ

General Information

POL-ARQ is a synchronous duplex FARQ system. This system was used by the Ministry of Foreign Affairs of Poland.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	270
Symbol rate (Bd)	100
Alphabet	CCIR-476

Table 201: POL-ARQ Characteristics

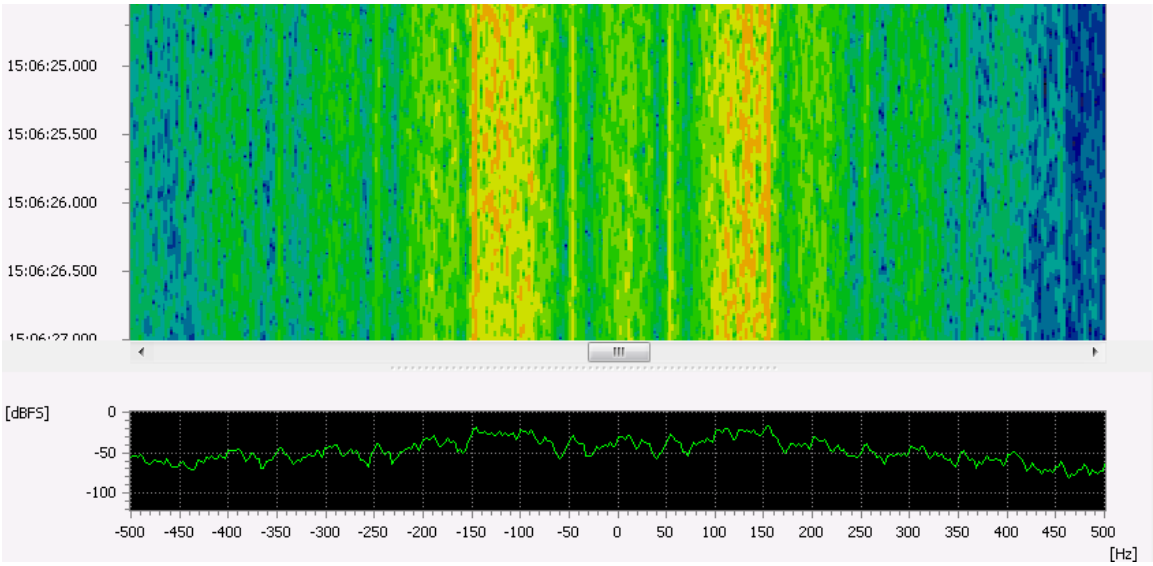


Figure 137: POL-ARQ Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	270
Shift tolerance (Hz)	30
Modem type	Synchronous
VER file name	*pol-arq_100bd.ver*

Table 202: POL-ARQ Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 203: POL-ARQ Features

PSK10

General Information

PSK10 is a modem type developed by radio amateurs. PSK10 emissions are very narrow-band and robust against fading effects.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK
Symbol rate (Bd)	10
Coding	Huffman coding

Table 204: PSK10 Characteristics

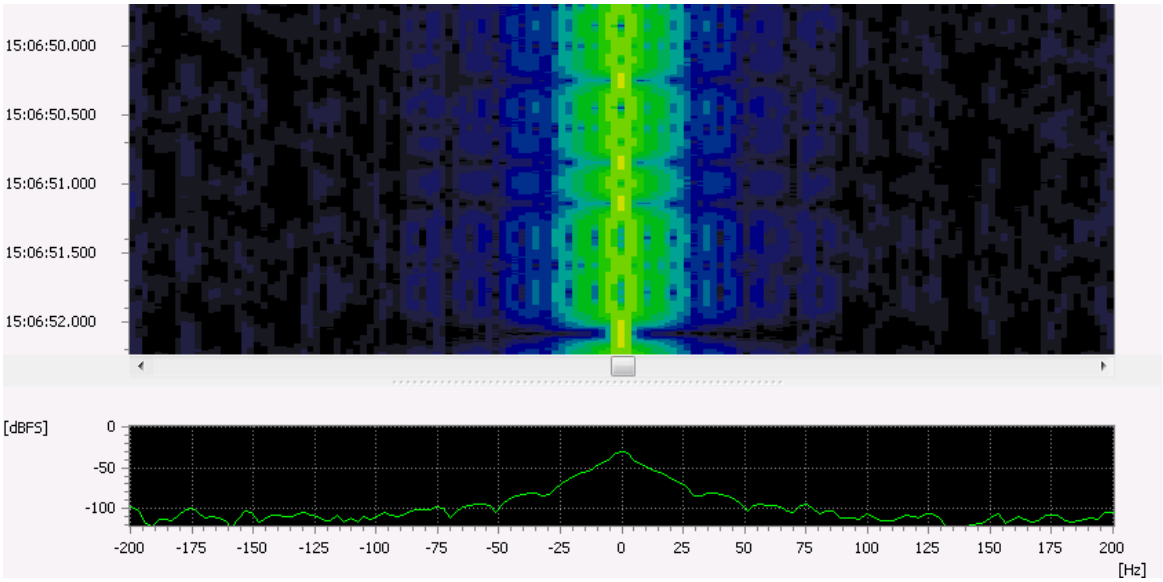


Figure 138: PSK10 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8,16 A/B
Symbol rate (Bd)	10
SR tolerance (Bd)	0.5
Modulation order	2
Version	A
VER file name	*psk10.ver*

Table 205: PSK10 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes

Feature	Status
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 206: PSK10 Features

PSK10-AM

General Information

PSK10-AM is a modem type developed by radio amateurs. PSK10-AM emissions are very narrow-band and robust against fading effects.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK
Symbol rate (Bd)	10 / 31.25 / 50
Coding	Repetition code

Table 207: PSK10-AM Characteristics

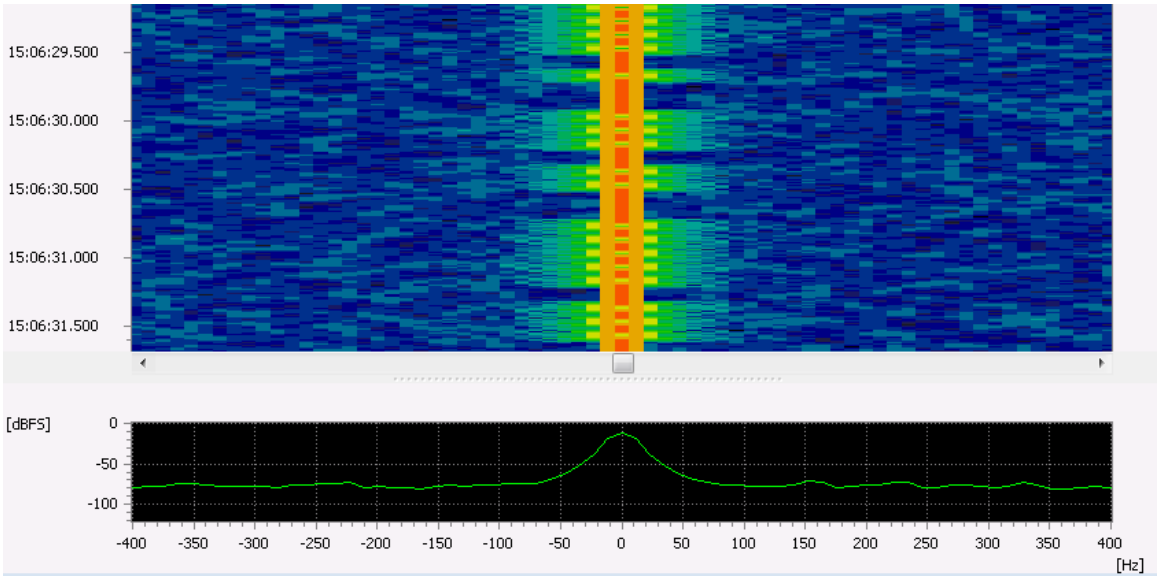


Figure 139: PSK10-AM Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8,16 A/B
Symbol rate (Bd)	10
SR tolerance (Bd)	5
Modulation order	2

Parameter	Default
Version	A
VER file name	*psk-am_10bd.ver*

Table 208: PSK10-AM Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 209: PSK10-AM Features

PSK31

General Information

PSK31 is a modem type developed by radio amateurs. PSK31 emissions are very narrow-band and robust against fading effects.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK,QPSK
Bandwidth (Hz)	50
Symbol rate (Bd)	31.25 (62.5 / 125)
Coding (FEC variants)	Convolutional FEC

Table 210: PSK31 Characteristics

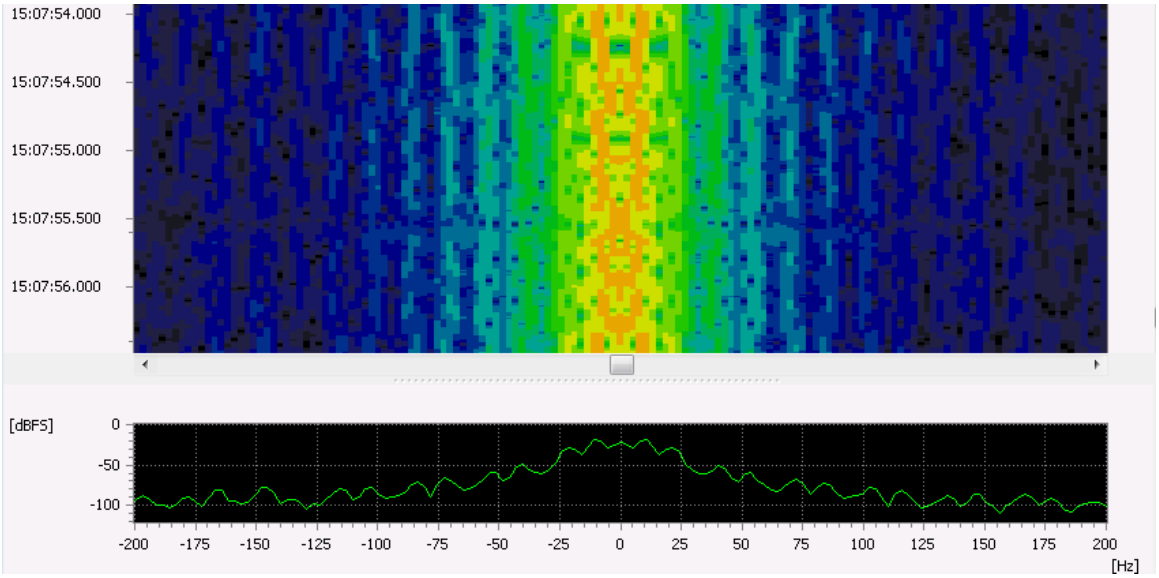


Figure 140: PSK31 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8,16 A/B
Symbol rate (Bd)	31
SR tolerance (Bd)	5
Modulation order	2
Version	A
VER file name	*psk31.ver*

Table 211: PSK31 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 212: PSK31 Features

RUM-FEC

General Information

RUM-FEC is a duplex FEC system used by the Ministry of Foreign Affairs of Romania.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Symbol rate (Bd)	164.5
Coding	Interleaving, FEC
Alphabet	RUM-FEC

Table 213: RUM-FEC Characteristics

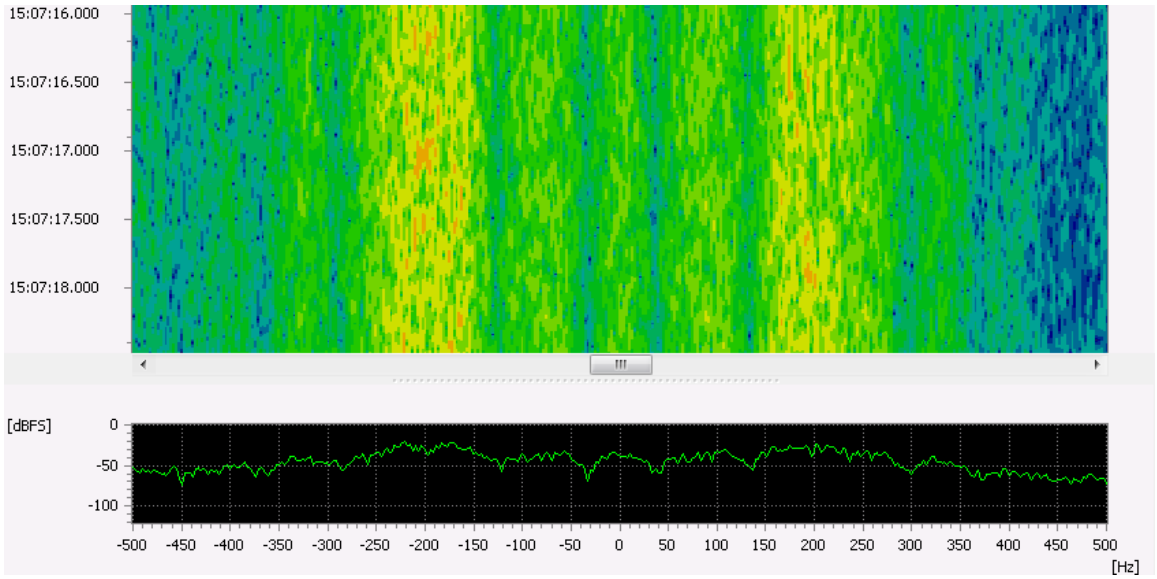


Figure 141: RUM-FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	165
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*rum-fec_165bd.ver*

Table 214: RUM-FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 215: RUM-FEC Features

SI-ARQ

General Information

SI-ARQ is an ARQ mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Basic maritime data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	400 / 500
Symbol rate (Bd)	96 / 192
Error correction	ARQ
Alphabet	ITA-2

Table 216: SI-ARQ Characteristics

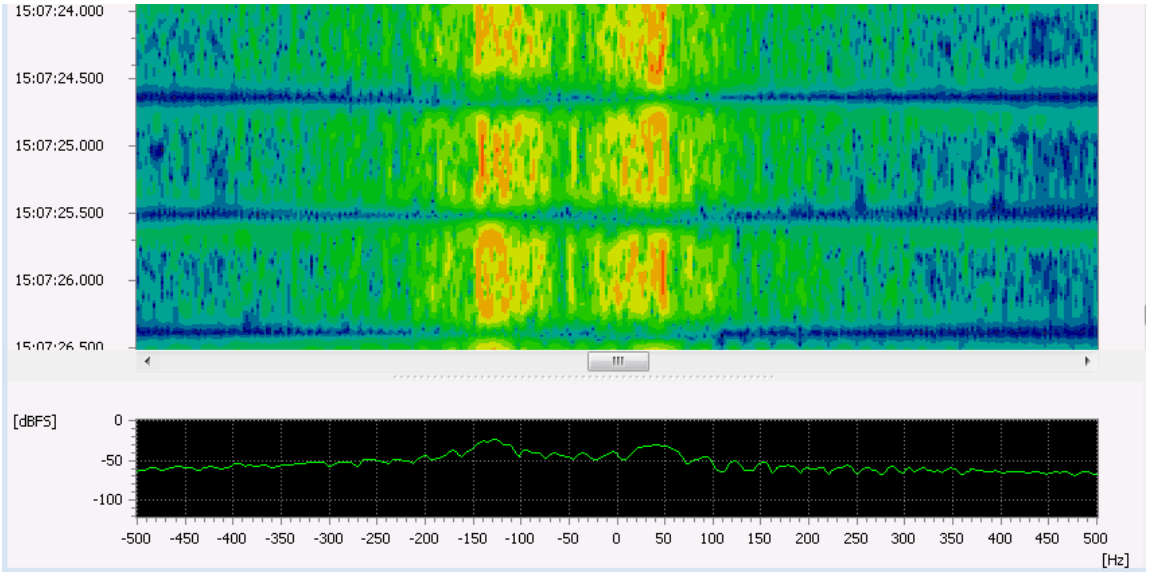


Figure 142: SI-ARQ Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	1
Shift (Hz)	170
Shift tolerance (Hz)	5
Modem type	Synchronous
Min. burst length (s)	0.217
Max. burst length (s)	0.600
Min. pause length (s)	0.061
VER file name	*si-arq.ver*

Table 217: SI-ARQ Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 218: SI-ARQ Features

SI-FEC

General Information

SI-FEC is an FEC mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Basic maritime data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	400 / 500
Symbol rate (Bd)	96 / 192
Error correction	FEC
Alphabet	ITA-2

Table 219: SI-FEC Characteristics

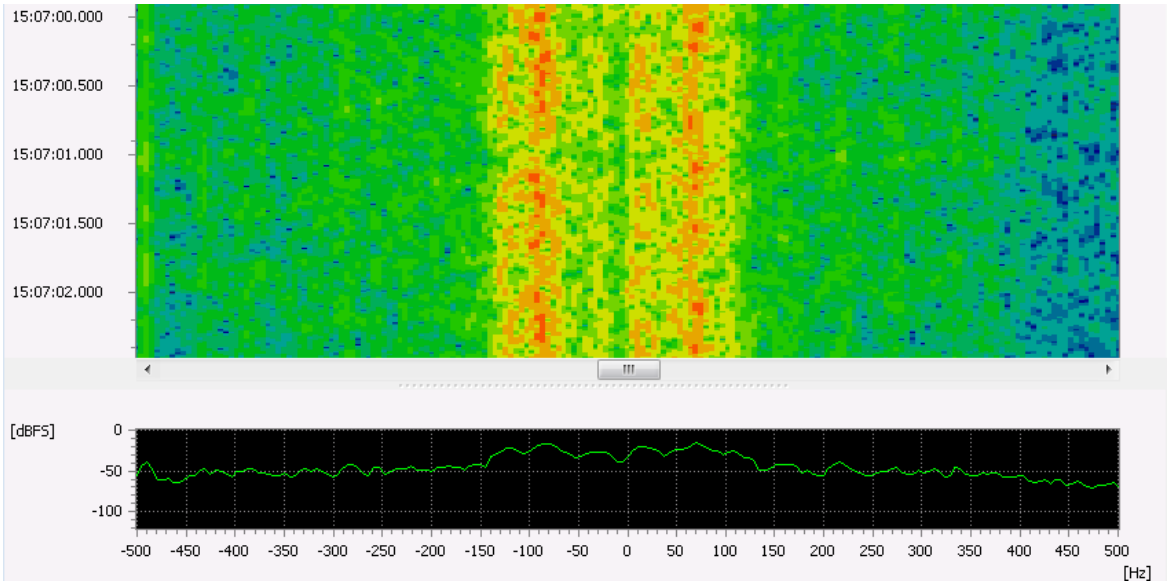


Figure 143: SI-FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*si-fec.ver*

Table 220: SI-FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 221: SI-FEC Features

SITOR-A

General Information

SImplex Teletype Over Radio (SITOR) is a mode for maritime communications to exchange teletype-data over a radio channel in a robust way.
SITOR-A is the ARQ variant.

Usage:

- Basic maritime data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	350
Symbol rate (Bd)	100
Error correction	ARQ
Alphabet	ITA-2

Table 222: SITOR-A Characteristics

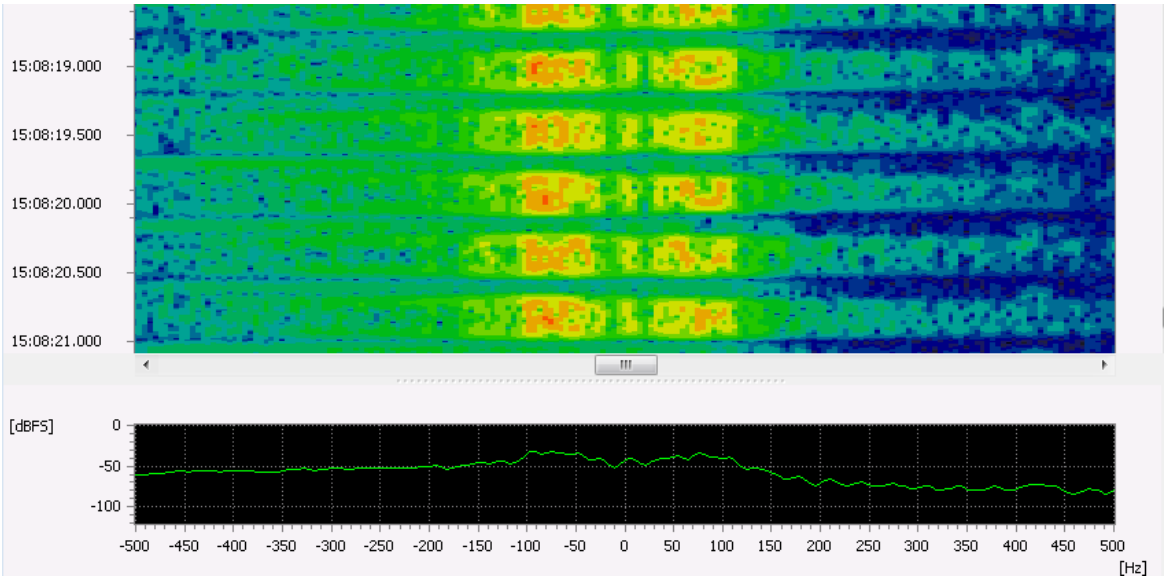


Figure 144: SITOR-A Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous

Parameter	Default
Min. burst length (s)	0.065
Max. burst length (s)	0.290
Min. pause length (s)	0.200
VER file name	*sitor-a_170hz.ver*

Table 223: SITOR-A Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 224: SITOR-A Features

SITOR-B

General Information

SImplex Teletype Over Radio (SITOR) is a mode for maritime communications to exchange teletype-data over a radio channel in a robust way.
SITOR-B is the FEC variant.

Usage:

- Basic maritime data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170 / 400
Bandwidth (Hz)	350 / 800
Symbol rate (Bd)	100
Error correction	FEC
Alphabet	ITA-2

Table 225: SITOR-B Characteristics

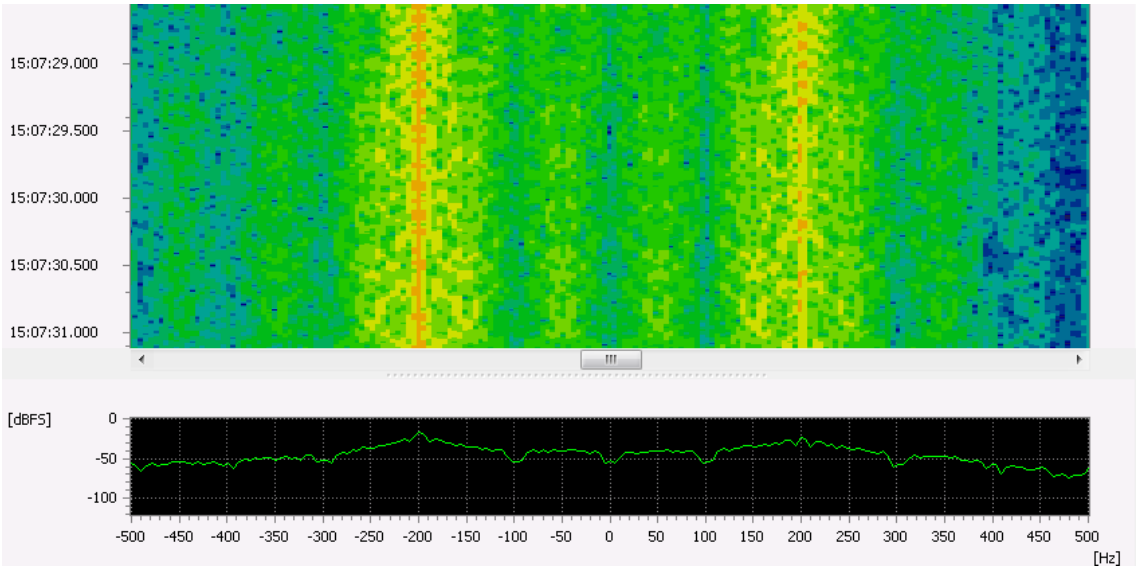


Figure 145: SITOR-B Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*sitor-b_100bd_400hz.ver*

Table 226: SITOR-B Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 227: SITOR-B Features

SP14

General Information

This standard is a system with 14 tones where only 13 tones are used. The carrier is AM modulated with a secondary MFSK modulation for the data.
SP-14 is equivalent to NUM-13.

Usage:

- Transmission of numeric codes.

Mode Properties

Parameter	Value
Modulation, primary secondary	AM MFSK
Number of tones	14
Tone length (ms)	133
Tone spacing (Hz)	16
Bandwidth (Hz)	210
Symbol rate (Bd)	7.5
Coding	Character coding

Table 228: SP14 Characteristics

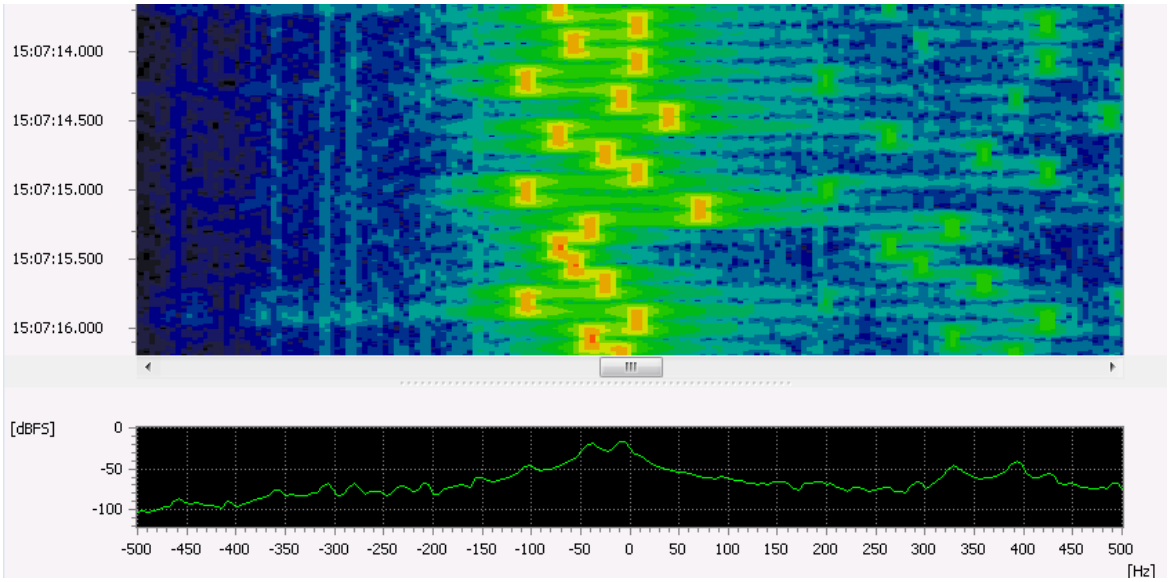


Figure 146: SP14 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	133
TD tolerance (ms)	5
No. of tones	14
Tone position type	Equidistant frequencies

Parameter	Default
Tone distance (Hz)	16
VER file name	*sp14.ver*

Table 229: SP14 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 230: SP14 Features

SPREAD 51

General Information

SPREAD 51 is a synchronous FEC system which was used by the Ministry of Foreign Affairs in Romania.
Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Symbol rate (Bd)	102.7
Coding	10 Bit Bauer code, Interleaving
Alphabet	ITA-2

Table 231: SPREAD 51 Characteristics

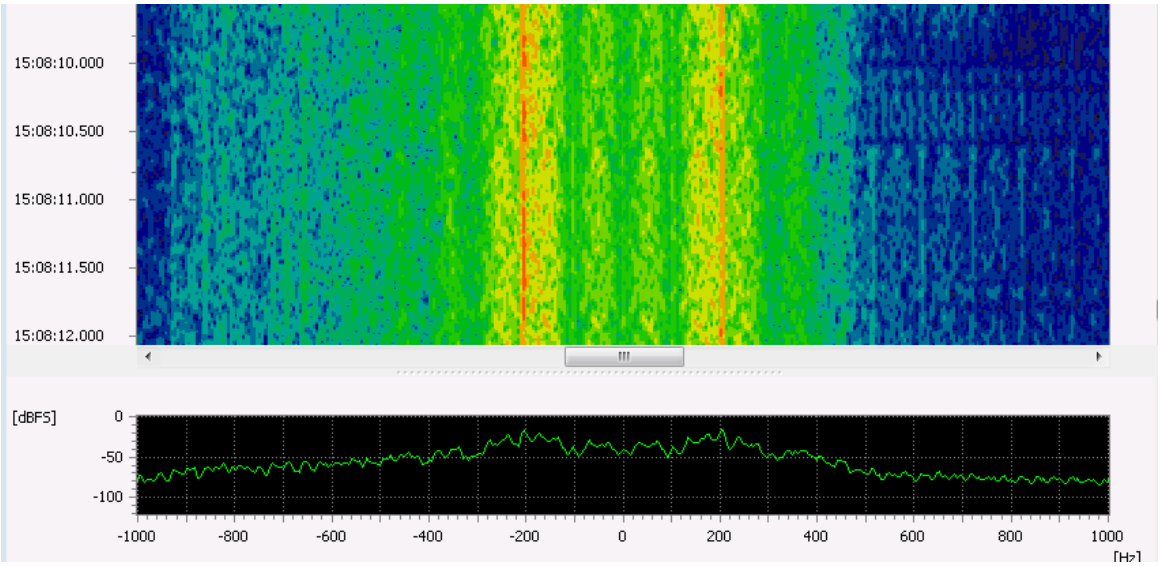


Figure 147: SPREAD 51 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	102.7
SR tolerance (Bd)	1
Shift (Hz)	400
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*spread51.ver*

Table 232: SPREAD 51 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 233: SPREAD 51 Features

SWED-ARQ

General Information

SWED-ARQ is an adaptive fsk system which was used for diplomatic communication with Swedish embassies. This system is no longer in operation.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Symbol rate (Bd)	100
Alphabet	CCIR-476

Table 234: SWED-ARQ Characteristics

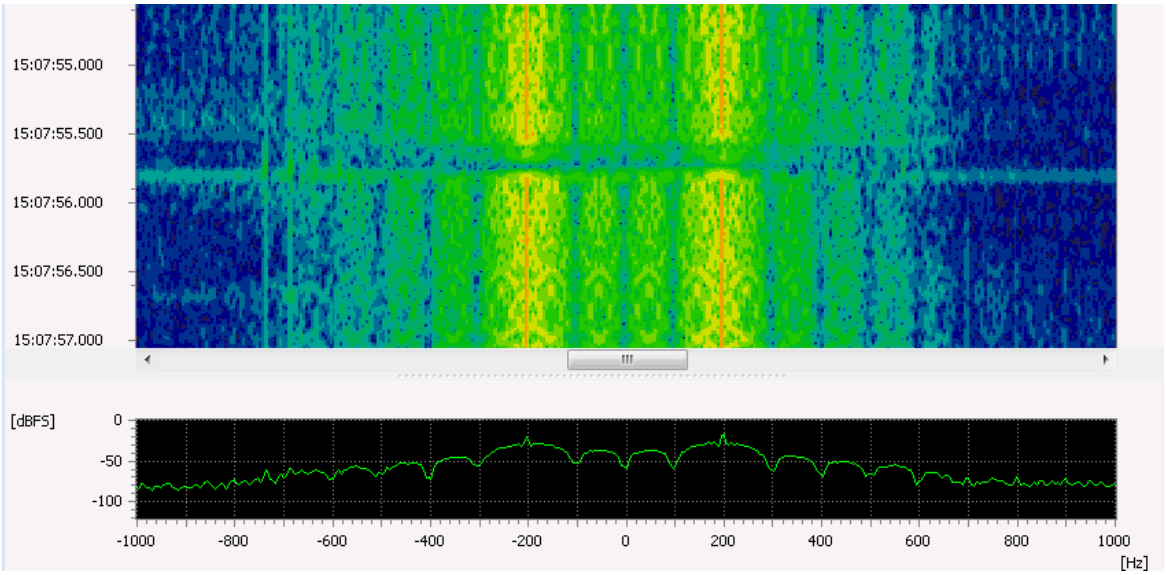


Figure 148: SWED-ARQ Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.065
Max. burst length (s)	1.700
Min. pause length (s)	0.200
VER file name	*swed_arqver*

Table 235: SWED-ARQ Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 236: SWED-ARQ Features

TWINPLEX

General Information

TWINPLEX is a 2 channel frequency domain multiplex ARQ system for data communications.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	4
Symbol rate (Bd)	50
Error correction	ARQ
Alphabet	ITA-3

Table 237: TWINPLEX Characteristics

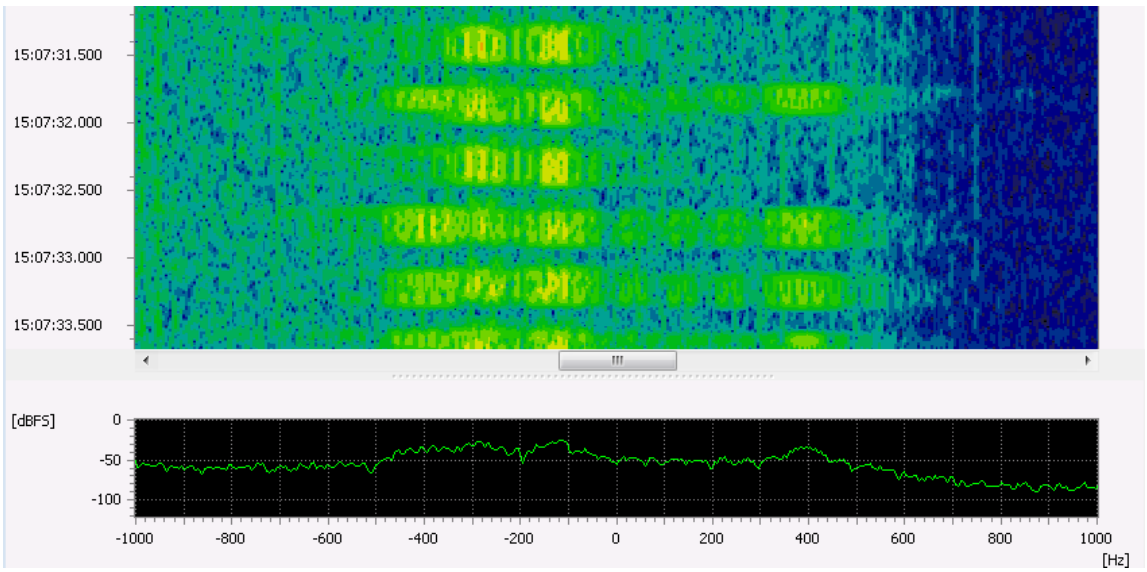


Figure 149: TWINPLEX Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	F6/F7B
F7B mode	Data (interleaved)
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Distance F1 <-> F2 (Hz)	115
Distance F2 <-> F3 (Hz)	170
Distance F3 <-> F4 (Hz)	515
Shift tolerance (Hz)	20
Min. burst length (s)	0.180
Max. burst length (s)	0.250
Min. pause length (s)	0.100
VER file name	twinplex.ver

Table 238: TWINPLEX Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 239: TWINPLEX Features

Visel

General Information

Visel is a synchronous teleprinter system used in former Yugoslavia.
It is unknown whether the system is still in use.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	300
Symbol rate (Bd)	81.3 / 123.5 / 125
Error correction	FEC
Alphabet	ITA-2

Table 240: Visel Characteristics

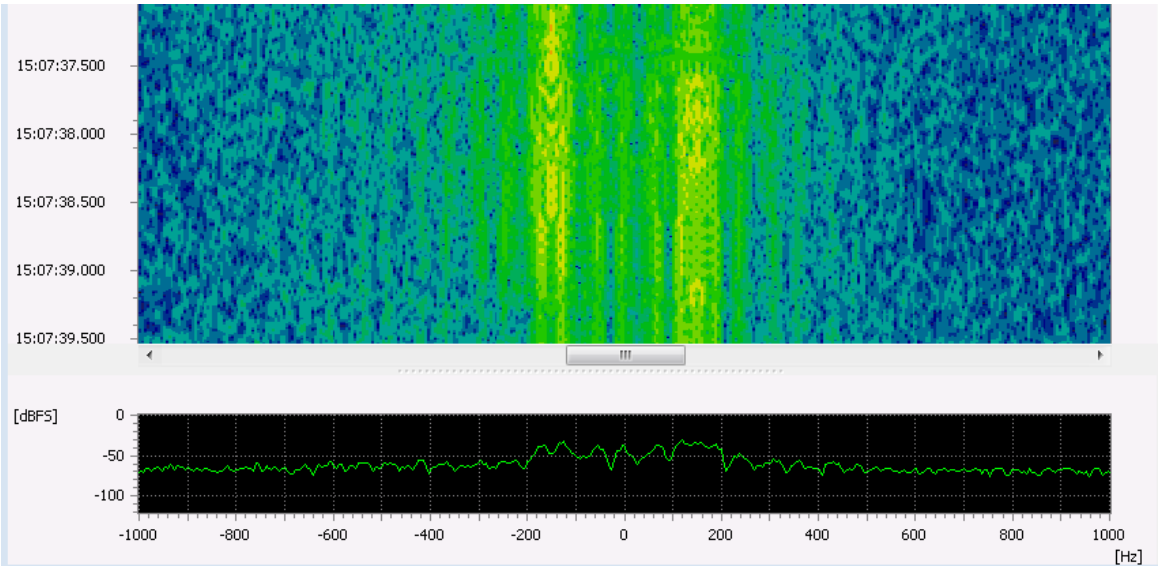


Figure 150: Visel Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	120.9
SR tolerance (Bd)	3
Shift (Hz)	300
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*visel.ver*

Table 241: Visel Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 242: Visel Features

Standard Decoders VHF/UHF

Version History

Release	Date	Editor	History
1.0	2013-07-05	MBu	Start

Available Decoders

ACARS VHF

General Information

Aircraft **C**ommunication **A**ddressing and **R**eporting **S**ystem (ACARS) is a digital datalink system for exchange of small messages between aircraft and ground stations.

Usage:

- Aeronautical communication on VHF.

Mode Properties

Parameter	Value
Modulation, primary secondary	DSB-AM MSK
Shift (Hz)	1200
Bandwidth (kHz)	25
Symbol rate (Bd)	2400
Coding	CRC

Table 243: ACARS VHF Characteristics

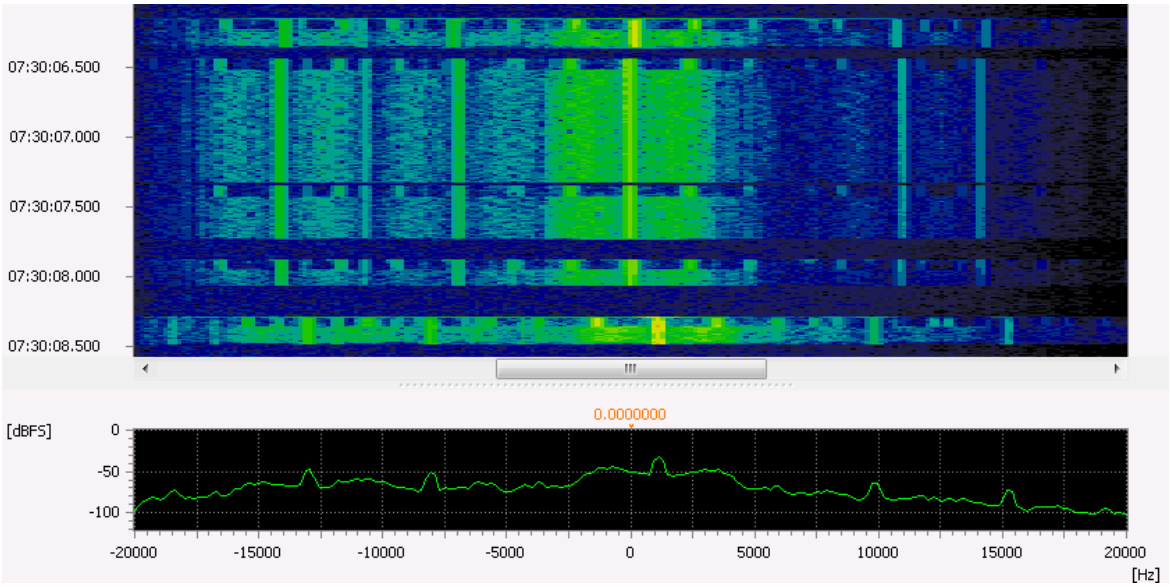


Figure 151: ACARS VHF Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	G (MSK)
Type	MSK
Symbol rate (Bd)	2400
SR tolerance (Bd)	2.000
BT	1.0
Min. burst length (s)	0.050
Max. burst length (s)	2.000
Min. pause length (s)	0.010
VER file name	*acars_vhf.ver*

Table 244: ACARS VHF Demodulator Settings

Tuning

- The tuning frequency is the peak 20 kHz above the low cutoff-frequency of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 245: ACARS VHF Features

AIS

General Information

The universal ship borne **A**utomatic **I**dentification **S**ystem (AIS) was created for efficient exchange of navigational data among ships and between ships and stations ashore to improve safety of navigation.

Usage:

- Worldwide radio system for ship collision avoidance and navigational advice.

Mode Properties

Parameter	Value
Modulation, primary secondary	FM GMSK
BT product 12.5 kHz 25 kHz	0.3 or 0.5 max 0.5
Symbol rate (Bd)	9600
Coding	NRZI and CRC

Table 246: AIS Characteristics

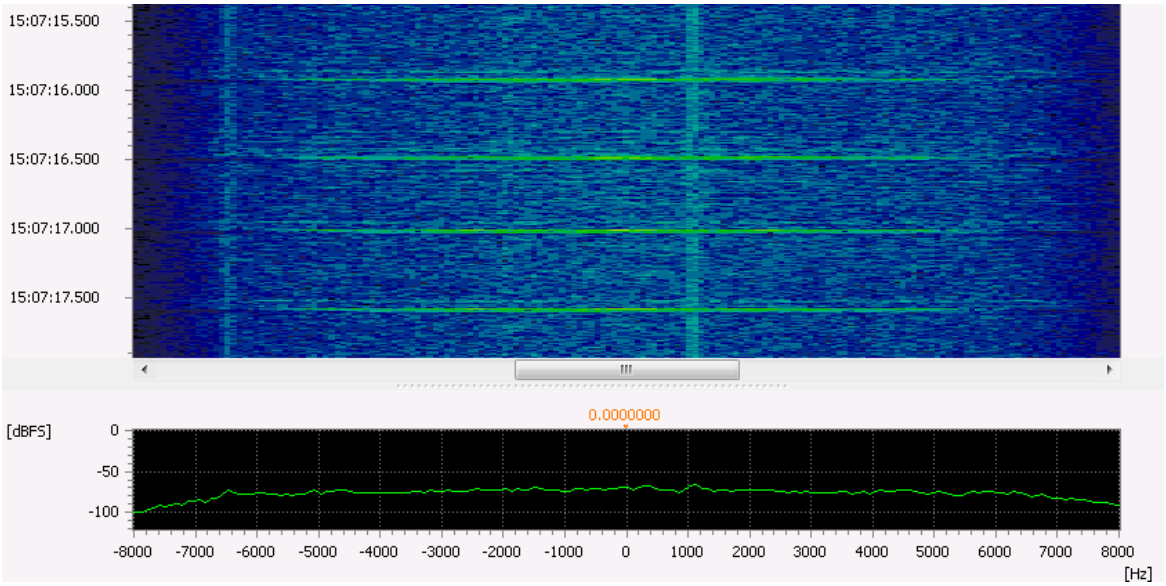


Figure 152: AIS Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	G (MSK)
Type	GMSK
Symbol rate (Bd)	9600
SR tolerance (Bd)	20.000
BT	0.40
Min. burst length (s)	0.040
Max. burst length (s)	0.080

Parameter	Default
Min. pause length (s)	0.440
VER file name	*ais.ver*

Table 247: AIS Demodulator Settings

Tuning

- The tuning frequency is 11.340 kHz above the pilot-tone.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 248: AIS Features

CCIR

General Information

These SelCal standards are based on the CCIR-Recommendations (now ITU) CCIR-1, CCIR-2(CCIR-7) and PCCIR. CCIR-1 and CCIR-2 vary in the nominal tone duration.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 249: CCIR Characteristics

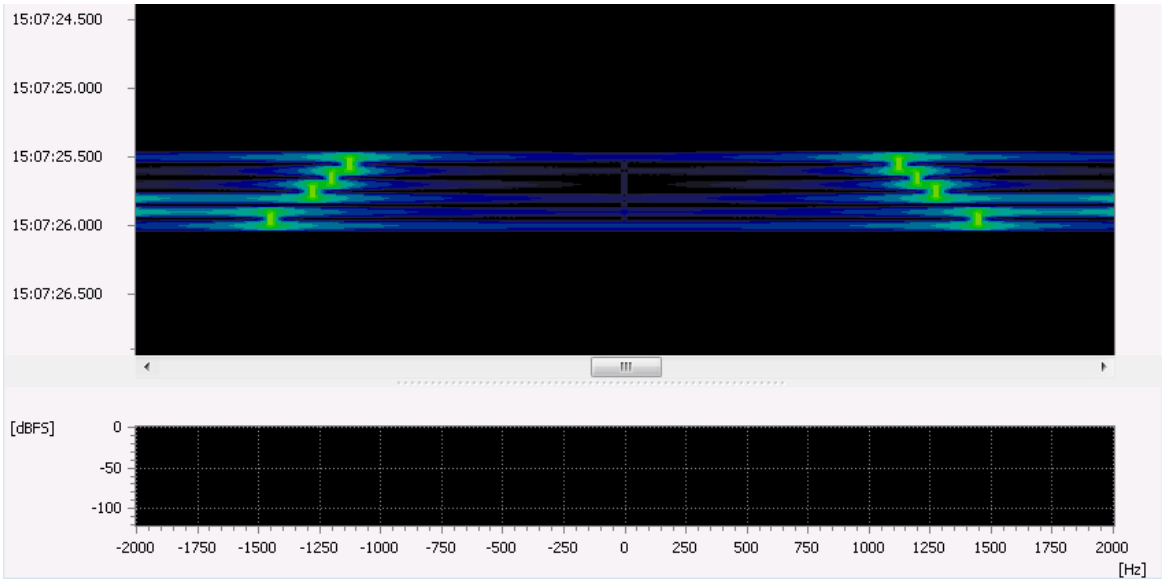


Figure 153: CCIR Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	100
TD tolerance (ms)	10
No. of tones	17
SELCAL type	CCIR-1/PCCIR
Min. burst length (s)	0.400
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	3
VER file name	*ccir.ver*

Table 250: CCIR Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 251: CCIR Features

CCITT

General Information

This SelCal standards is based on an CCITT-Recommendation (now ITU) for tone-based selective calling.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	15
Coding	Character coding

Table 252: CCITT Characteristics

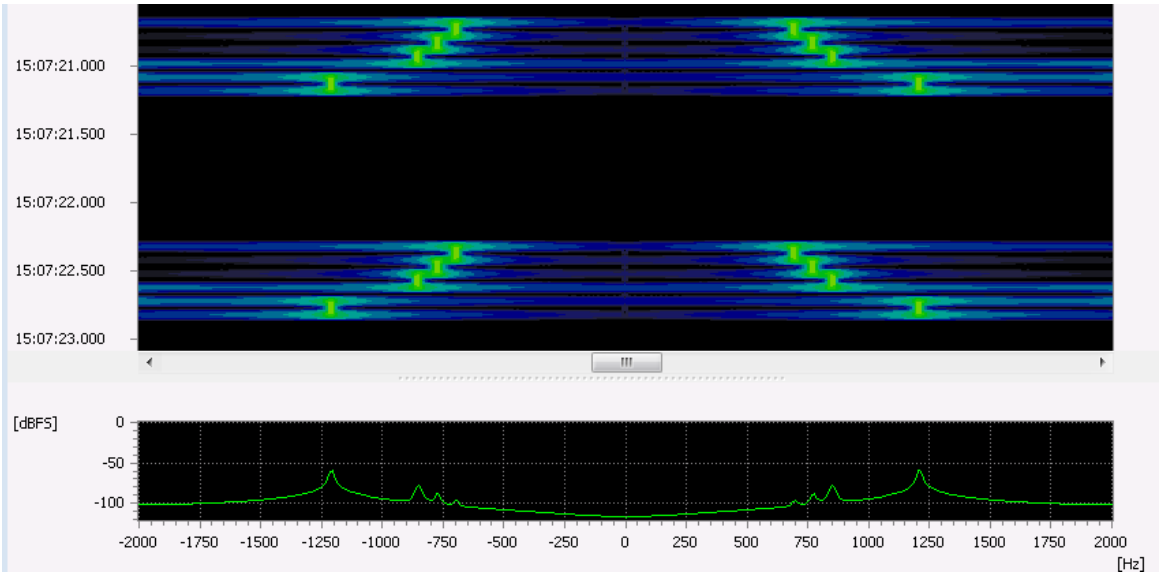


Figure 154: CCITT Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	100
TD tolerance (ms)	5
No. of tones	11
SELCAL type	Euro
Min. burst length (s)	0.400
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	3
VER file name	*ccitt.ver*

Table 253: CCITT Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 254: CCITT Features

CTCSS

General Information

The **C**ontinuous **T**one **C**oded **S**quelch **S**ystem (CTCSS) was developed for use with analog voice radios. Analog radios equipped with the CTCSS system transmit a tone simultaneously with the voice signal. CTCSS radios enable the selection of particular radio units by recognition of the CTCSS tones. CTCSS tones are standardized by the EIA/TIA, but some systems use non-standard tones

Usage:

- Analog voice radio with station selection.

Mode Properties

Parameter	Value
Modulation	Multi-tone
Number of tones	38

Table 255: CTCSS Characteristics

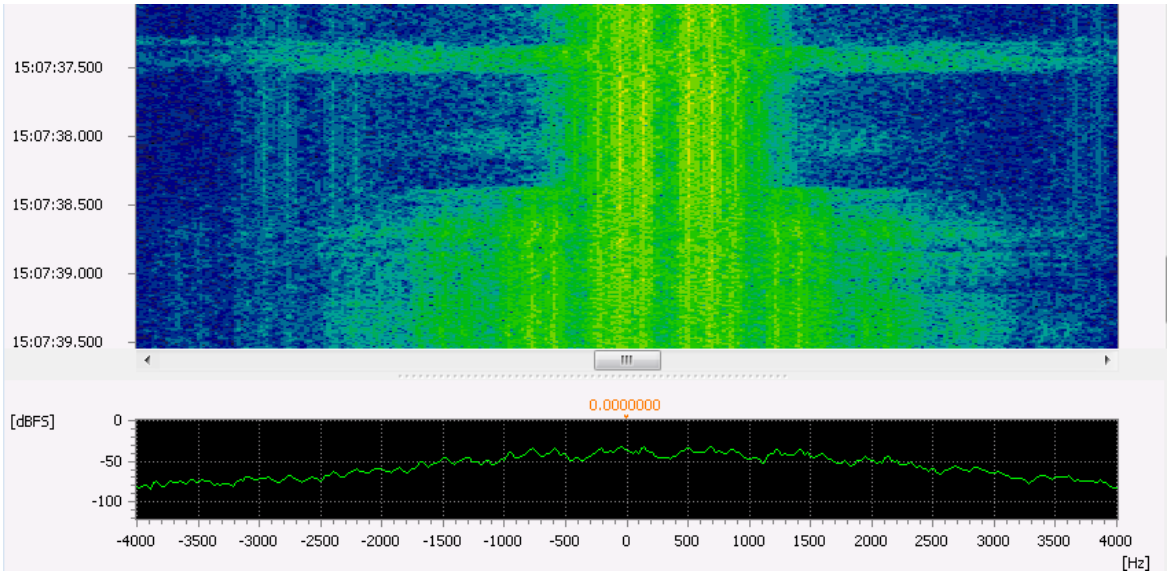


Figure 155: CTCSS Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Voice
Voice mode	F3E
SELCAL type	CTCSS
Sensitivity	Middle
VER file name	*ctcss.ver*

Table 256: CTCSS Demodulator Settings

Tuning

- The tuning frequency is 240 Hz below the center peak.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 257: CTCSS Features

DMR

General Information

Digital **M**obile **R**adio (DMR) is a digital modem with 12.5 kHz channel spacing and TDMA based protocol described in the ETSI technical standards.

TS 102 398: General Design

TS 102 361:

Part 1: DMR Air Interface (AI) protocol

Part 2: DMR voice and generic services and facilities

Part 3: DMR Data protocol

Part 4: DMR trunking protocol

TS 102 362: Conformance Testing

Usage:

- Category 1: Individuals and industries with low requirements, small-scale applications.
- Category 2: Industries with high demands on business-critical large-scale communication.

Mode Properties

Parameter	Value
Duplex method	FDD or TDD
Modulation	FSK

Parameter	Value
Number of tones	4
Tone spacing (Hz)	1296
Symbol rate (Bd)	4800

Table 258: DMR Characteristics

Figure 156: DMR Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	4800
SR tolerance (Bd)	10
Modulation order	4
Shift (Hz)	4080
Shift tolerance (Hz)	0
Modem type	Synchronous
Min. burst length (s)	0.015
Max. burst length (s)	0.045
Min. pause length (s)	0.015
VER file name	*dmr.ver*

Table 259: DMR Demodulator Settings

Tuning

- The tuning frequency is 240 Hz below the center peak.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding, Binary Data Voice Data	yes under development
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 260: DMR Features

Vocoder

The DVSI AMBE+2™ vocoder is based on Multi-Band Excitation (MBE), i.e. a frequency domain approach. Main characteristics are:

- very low bit rate 2450 bps (voice) + 1150 bps (FEC) = 3600 bps.
- very high voice quality at very low bit rate.
- robust to strong background noise and to PMR/LMR channel.
- moderate complexity, easy to implement on a low-cost DSP.
- language independent.

- 20ms voice frame and FEC optimized for PMR/LMR applications.
- soft bits based decoding.

dPMR

General Information

digital **P**rivate **M**obile **R**adio (dPMR) is a digital radio protocol for voice and data communications. dPMR is a narrowband (6,25 kHz channel spacing) FDMA based protocol described in the ETSI technical standards TS102 490 and TS102 658.

Usage:

- Professional and private voice & data communications.

Mode Properties

Parameter	Value
Modulation	Multi tone
Number of tones	4
Tone spacing (Hz)	700
Symbol rate (Bd)	2400
Coding	FEC

Table 261: dPMR Characteristics

Figure 157: dPMR Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	2400
SR tolerance (Bd)	1
Modulation order	4
Shift (Hz)	2200
Shift tolerance (Hz)	0
Modem type	Synchronous
VER file name	*dpmr.ver*

Table 262: dPMR Demodulator Settings

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding, Binary Data Voice Data	yes under development
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 263: dPMR Features

DSC

General Information

DSC (**D**igital **S**elective **C**alling) is part of the GMDSS (Global Maritime Distress and Safety System). It provides automatically formatted distress alerts, urgency, safety and routine radio-telephone calls.

Usage:

- Data communication over HF / VHF.

Mode Properties

Parameter	Value
Modulation, primary secondary	FM FSK
Number of tones	2
Shift (Hz)	800
Bandwidth (KHz)	10
Symbol rate (Baud)	1200
Coding	Checksum

Table 264: DSC VHF Characteristics

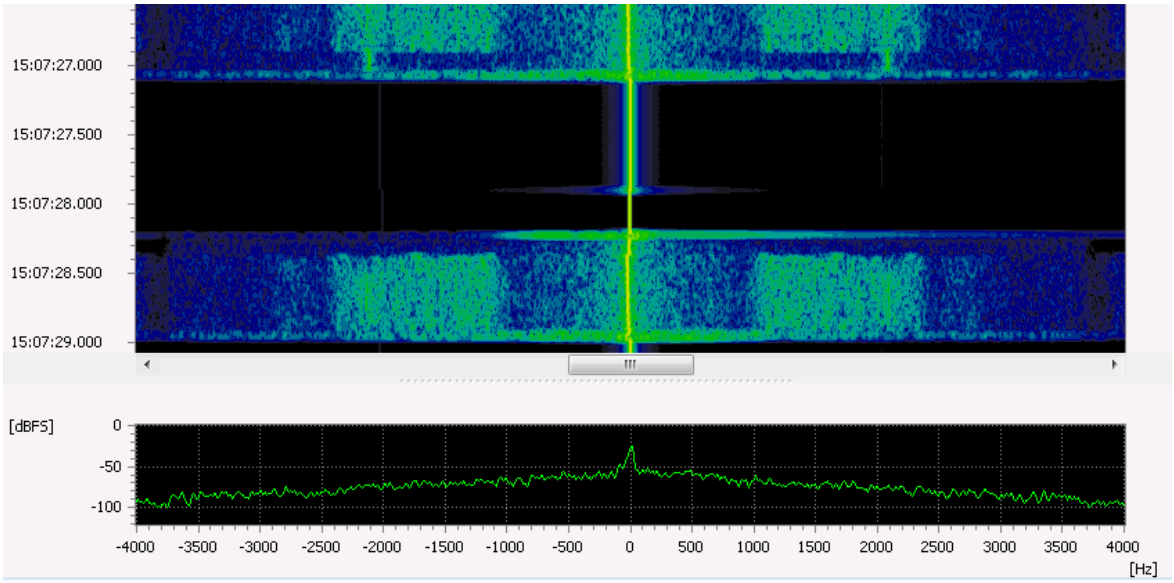


Figure 158: DSC VHF Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	1200
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	800

Parameter	Default
Shift tolerance (Hz)	20
Modem type	Synchronous
Min. burst length (s)	0.300
Max. burst length (s)	0.600
Min. pause length (s)	0.100
VER file name	*dsc-vhf.ver*

Table 265: DSC VHF Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment VHF	yes
Combination with other modems (modem list)	yes

Table 266: DSC Features

EEA

General Information

The EEA SelCal standard was defined by the **E**lectronic **E**ngineering **A**ssociation, UK.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 267: EEA Characteristics

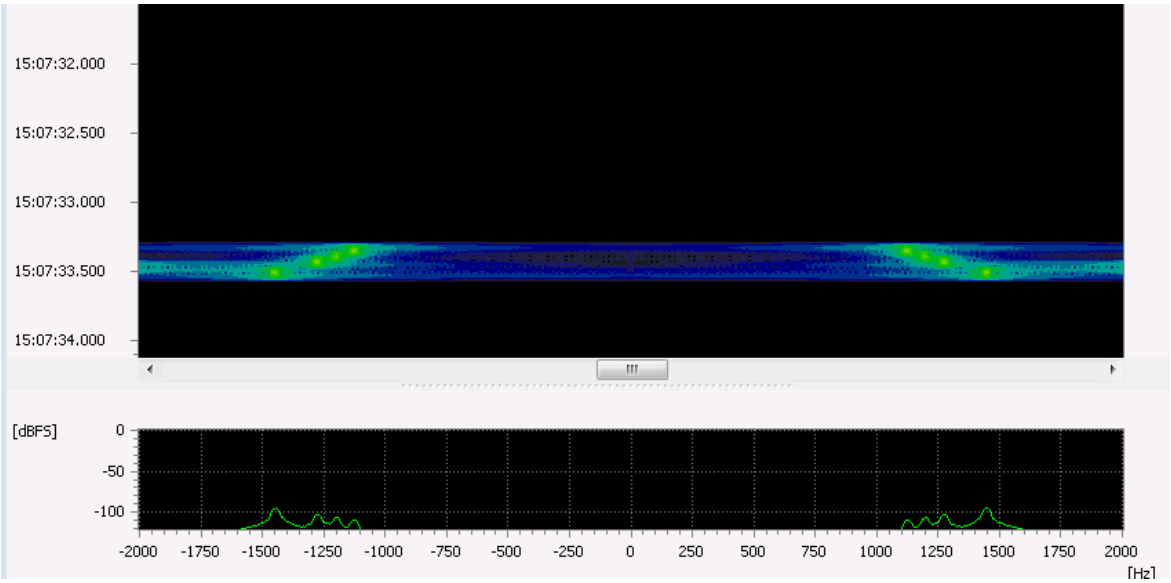


Figure 159: EEA Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	40
TD tolerance (ms)	4
No. of tones	16
SELCAL type	EEA
Min. burst length (s)	0.160
Max. burst length (s)	1.000
Min. pause length (s)	0.040
Min. burst SNR (dB)	0
VER file name	*eea.ver*

Table 268: EEA Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 269: EEA Features

EIA

General Information

The EEA SelCal standard was defined by the **E**lectronics **I**ndustries **A**ssociation, USA.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	15
Coding	Character coding

Table 270: EIA Characteristics

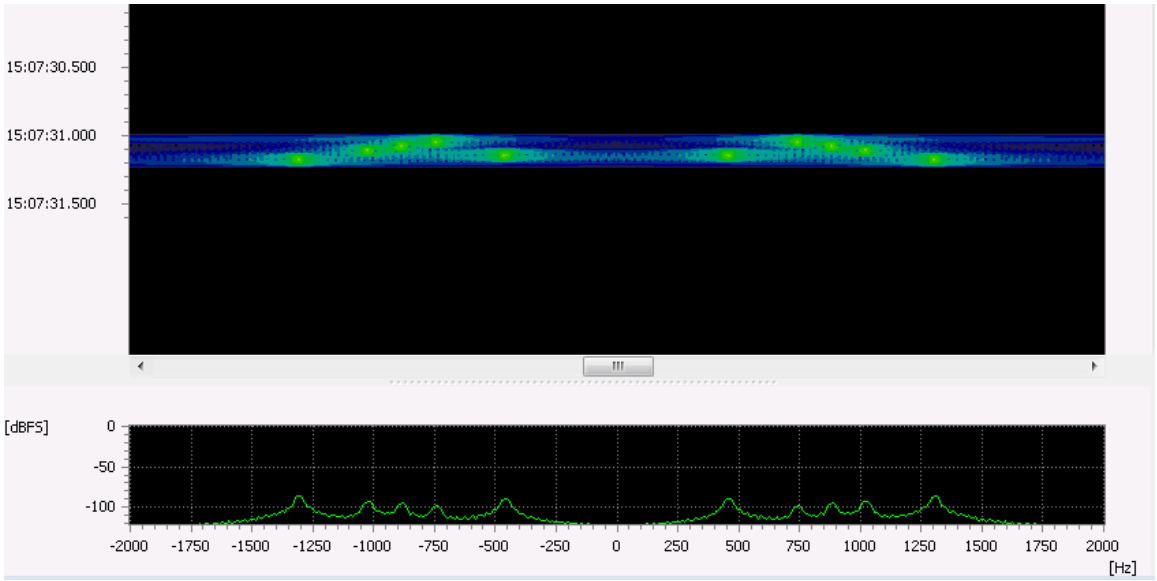


Figure 160: EIA Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	33
TD tolerance (ms)	4
No. of tones	15
SELCAL type	EIA
Min. burst length (s)	0.132
Max. burst length (s)	1.000
Min. pause length (s)	0.033
Min. burst SNR (dB)	0
VER file name	*eia.ver*

Table 271: EIA Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 272: EIA Features

Euro

General Information

Euro is an SelCal supplement to the analog voice transmission capability which enables an operator to address his call to single subscribers or groups.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 273: Euro Characteristics

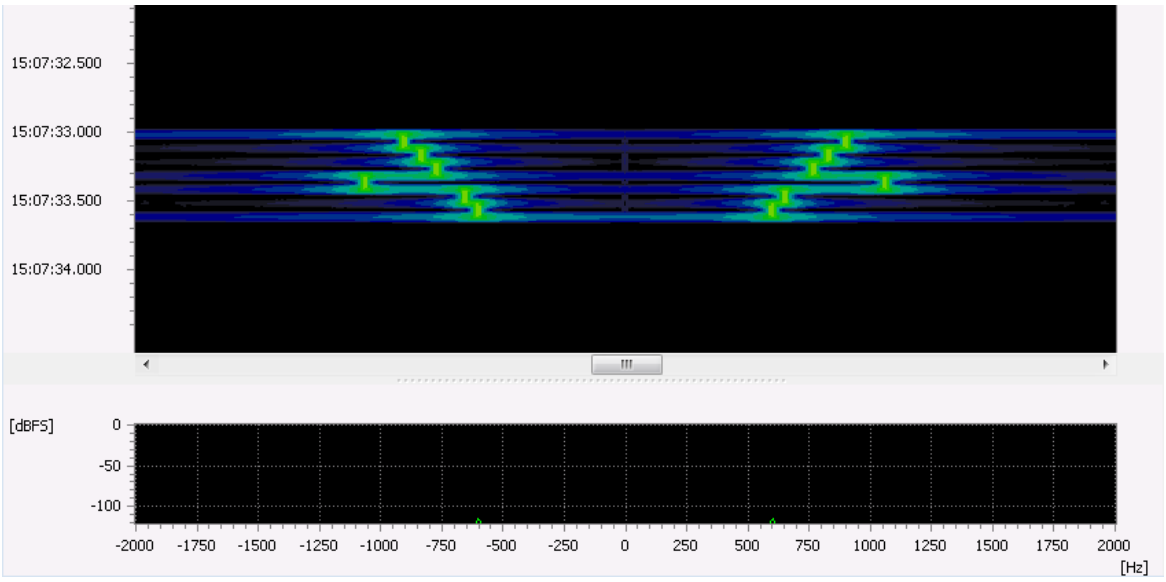


Figure 161: Euro Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	100
TD tolerance (ms)	5
No. of tones	11
SELCAL type	Euro
Min. burst length (s)	0.400
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	3
VER file name	*euro.ver*

Table 274: Euro Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 275: Euro Features

FLEX

General Information

FLEX is a high speed pager protocol developed by Motorola. Two Messaging Systems are currently defined, the FLEX one-way data messaging protocol and the ReFLEX two-way data messaging protocol.

Usage:

- Broadcast paging on VHF.

Mode Properties

Parameter	Value
Modulation	FFSK-2 FFSK-4
Symbol rate (Bd)	1600 3200
Data rate (bps)	1600 3200 6400
Coding	BCH(31,21)
Alphabet	ITA-5

Table 276: FLEX Characteristics

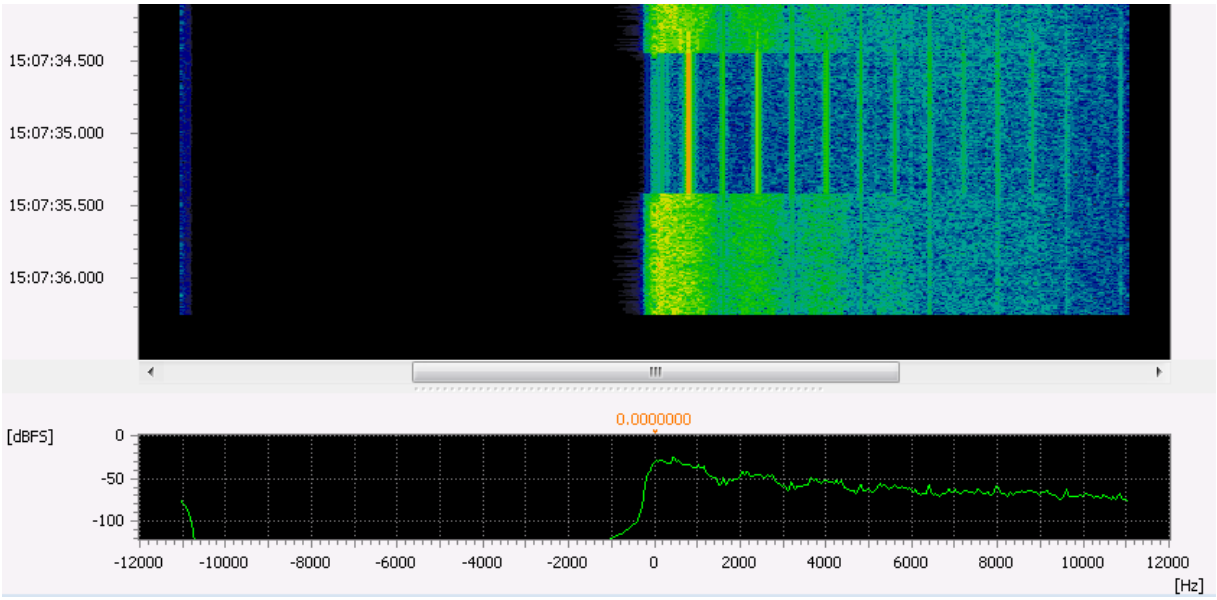


Figure 162: FLEX Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	1600
SR tolerance (Bd)	5
Shift (Hz)	9600
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*flex_1600bd_fsk2*

Table 277: FLEX Demodulator Settings

Tuning

- The tuning frequency is the lowest tone.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding, FFSK-2 FFSK-4	yes no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 278: FLEX Features

FMS-BOS

General Information

The radio reporting system, German "**F**unk**M**elde**S**ystem" (FMS), for agencies and organizations with safety assignments, German "**B**ehörden und **O**rganisationen mit **S**icherheitsaufgaben" (BOS), is a radio communication system for security authorities and organizations.

Usage:

- VHF security related communications.

Mode Properties

Parameter	Value
Modulation, primary secondary	FM FSK
Shift (Hz)	600
Bandwidth (Hz)	1800
Symbol rate (Bd)	1200
Coding	BCD and CRC

Table 279: FMS-BOS Characteristics

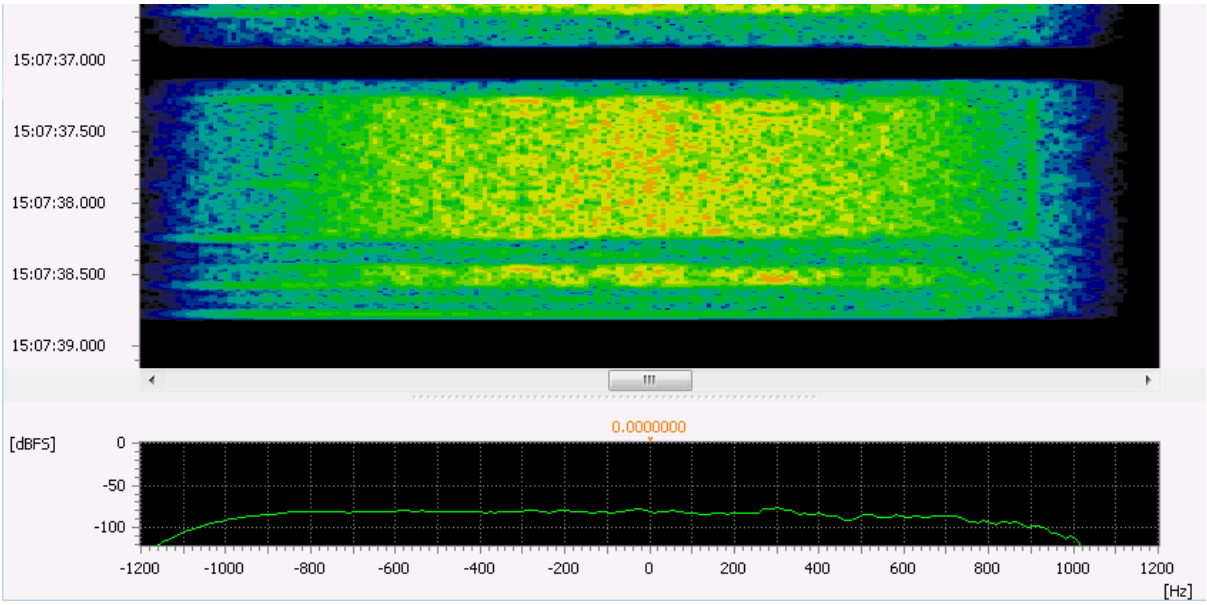


Figure 163: FMS-BOS Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	1200
SR tolerance (Bd)	10
Modulation order	2
Shift (Hz)	600
Shift tolerance (Hz)	10
Modem type	Synchronous

Parameter	Default
Min. burst length (s)	0.120
Max. burst length (s)	1.200
Min. pause length (s)	0.150
VER file name	*fms_bos.ver*

Table 280: FMS-BOS Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 281: FMS-BOS Features

Golay Pager

General Information

Golay - Pager is a paging protocol developed by Motorola Inc. Another designation for this modem type is Golay Sequential Code (GSC).

Usage:

- Alert and status messages, emergency services etc. on VHF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	2000
Bandwidth (Hz)	2600
Symbol rate (Bd)	300 / 600
Coding	Golay(23,12) and BCH(15,7)

Table 282: Golay Pager Characteristics

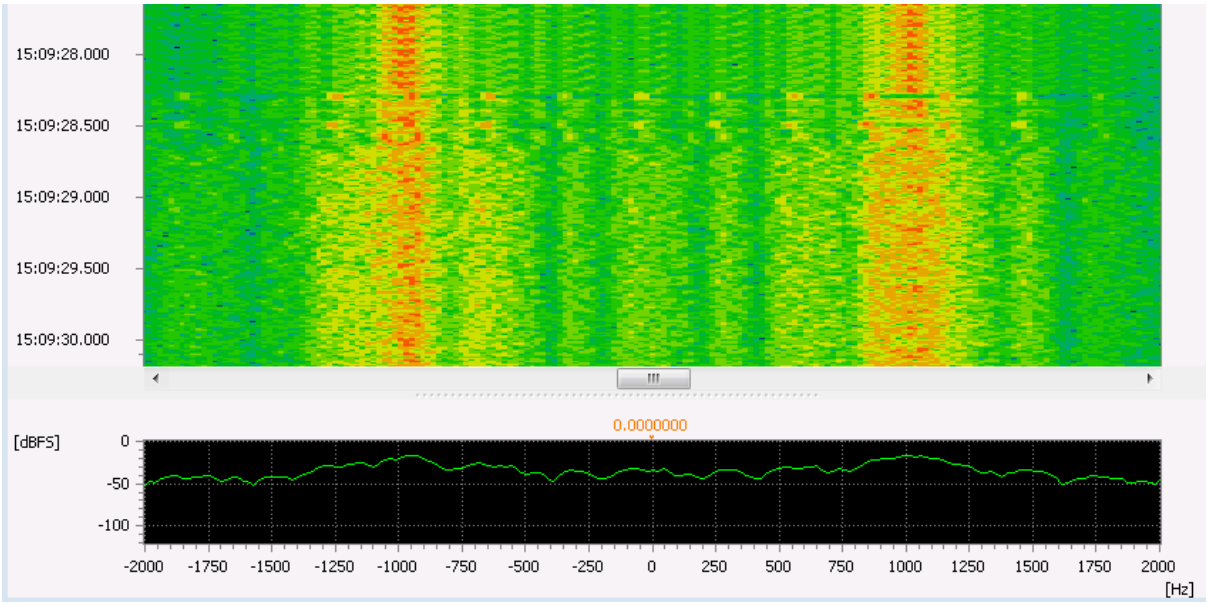


Figure 164: Golay Pager Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	600
SR tolerance (Bd)	5
Shift (Hz)	2000
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*golay_pager.ver*

Table 283: Golay Pager Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 284: Golay Pager Features

MPT1327

General Information

MPT1327 is a Signaling Standard for Trunked Private Land Line Mobile Radio Systems, issued by the British Radiocommunication Agency.

Usage:

- Mobile voice and data communication.

Mode Properties

Parameter	Value
Modulation	FFSK
Number of channels	1 + 1024
Bandwidth (Hz)	12500
Symbol rate (Bd)	1200
Coding	CRC

Table 285: MPT1327 Characteristics

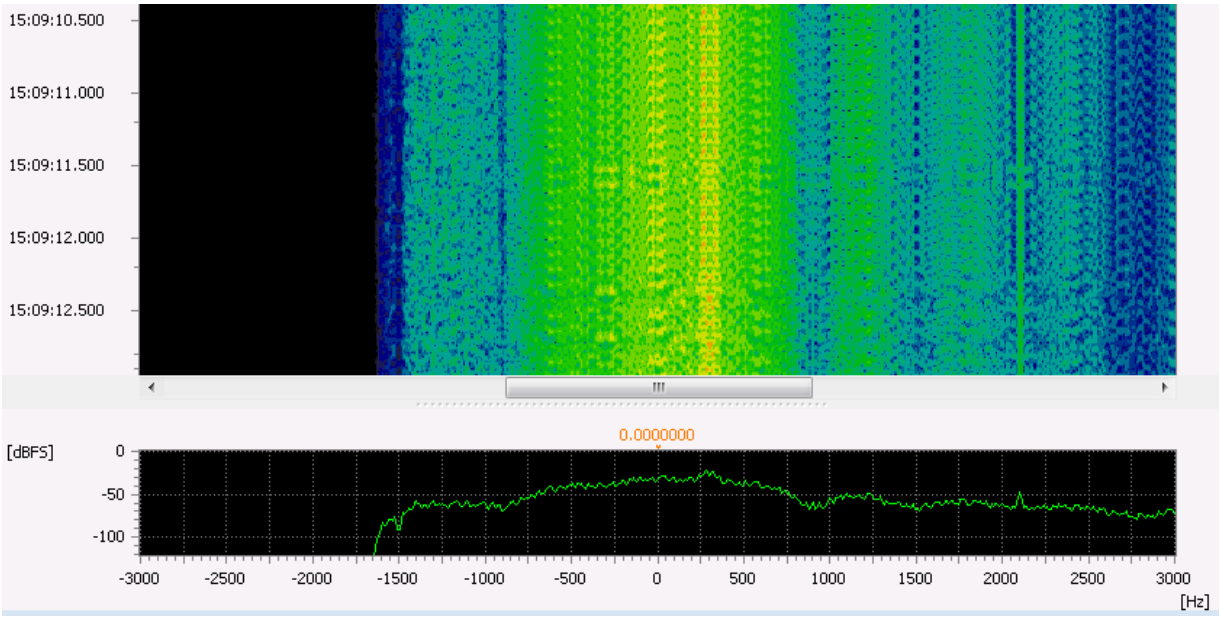


Figure 165: MPT1327 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	(G)MSK
Type	MSK
Symbol rate (Bd)	1200
SR tolerance (Bd)	5
Min. burst length (s)	0.010
Max. burst length (s)	60.000
Min. pause length (s)	0.010
VER file name	*Mpt1327_1200bd_msk.ver*

Table 286: MPT1327 Demodulator Settings

Tuning

- The tuning frequency is 1500 Hz above the low end of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 287: MPT1327 Features

Restriction

This decoder processes data on the TSC (Trunking System Controller) level only, not on the RU (Radio Unit) level.

NATEL

General Information

The NATEL SelCal standard was defined by the Scandinavian National Telephone.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 288: NATEL Characteristics

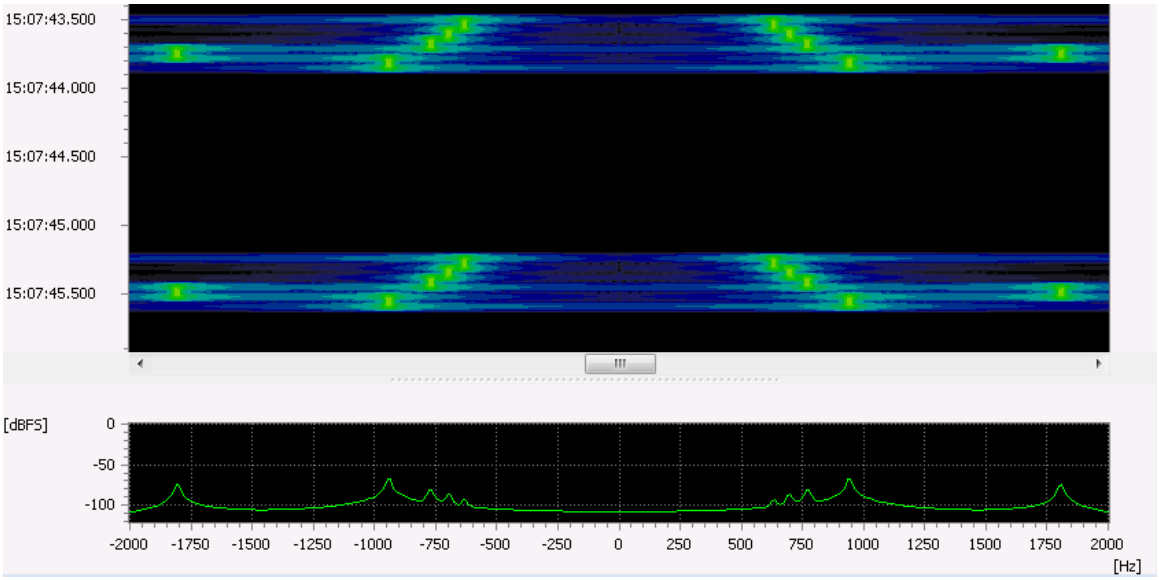


Figure 166: NATEL Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	70
TD tolerance (ms)	15
No. of tones	16
SELCAL type	NATEL
Min. burst length (s)	0.280
Max. burst length (s)	1.000
Min. pause length (s)	0.070
Min. burst SNR (dB)	3
VER file name	*natel.ver*

Table 289: NATEL Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 290: NATEL Features

NMT450

General Information

The **N**ordic **M**obile **T**elephone standard NMT-450 is an analog mobile telephone system developed by Telecommunications Administrations of Denmark, Finland, Norway and Sweden.

Usage:

- Public mobile phone network on UHF (450 MHz, 900 MHz with some restrictions).

Mode Properties

Parameter	Value
Modulation	FFSK
Shift (Hz)	600
Symbol rate (Bd)	1200
Coding	Convolutional FEC

Table 291: NMT450 Characteristics

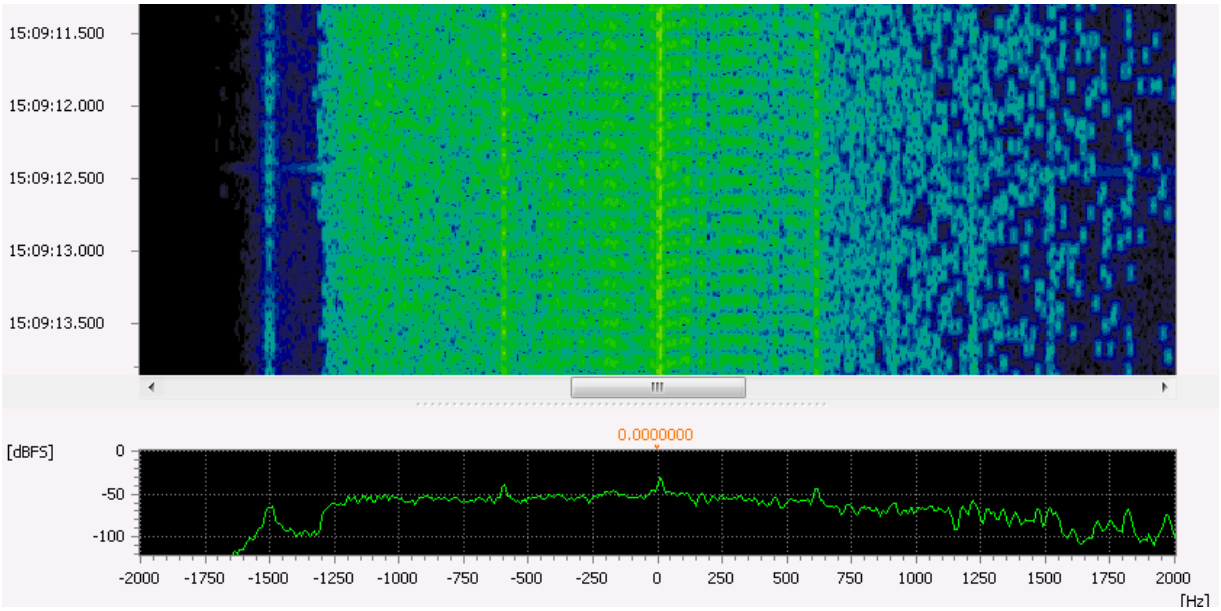


Figure 167: NMT450 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	(G)MSK
Type	MSK
Symbol rate (Bd)	1200
SR tolerance (Bd)	100
VER file name	*nmt450.ver*

Table 292: NMT450 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 293: NMT450 Features

POCSAG

General Information

The **P**ost **O**ffice **C**ode **S**tandard **A**dvisory **G**roup (POCSAG) pager defines the format used to encode messages and the standards for message transmission.

Usage:

- Pager in the VHF/UHF frequency range used by PTT administrations.

Mode Properties

Parameter	Value
Modulation	FFSK
Number of tones	2
Symbol rate (Bd)	512 / 1200 / 2400
Coding	BCH(31,21)
Alphabet	ITA-5

Table 294: POCSAG Characteristics

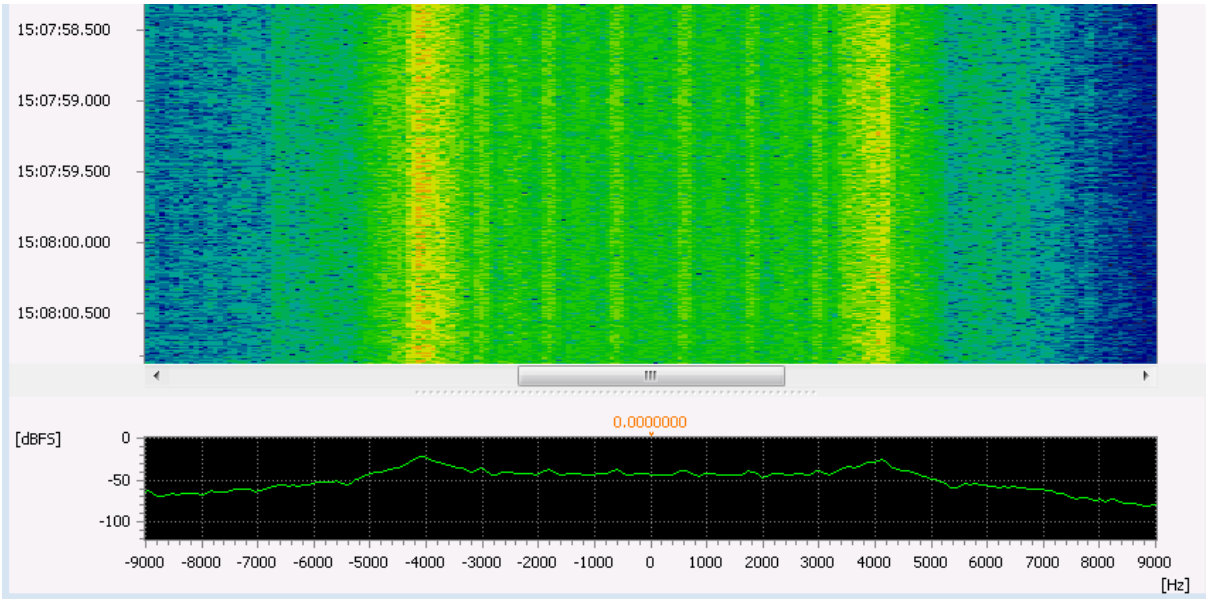


Figure 168: POCSAG Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK2 matched
Symbol rate (Bd)	1200
SR tolerance (Bd)	5
Shift (Hz)	8500
Shift tolerance (Hz)	500
Modem type	Synchronous
VER file name	*pocsag_1200bd.ver*

Table 295: POCSAG Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 296: POCSAG Features

TETRA

General Information

TErrestrial **TR**unked r**A**dio (TETRA) is a standard for digital voice and data mobile communication over radio. The standard has been released by ETSI organisation. More than 100 countries across Europe, Middle East, Africa, Asia Pacific, Caribbean and Latin America are using TETRA systems. The standard is being updated and extended continuously by ETSI.

Usage:

- Communication in the VHF/UHF frequency range among closed user groups such as public safety, military, industry and transportation.

Mode Properties

Parameter	Value
Modulation	DQPSK
Bandwidth (Hz)	25000
Symbol rate (Bd)	18000
Coding	FEC, encryption

Table 297: TETRA Characteristics

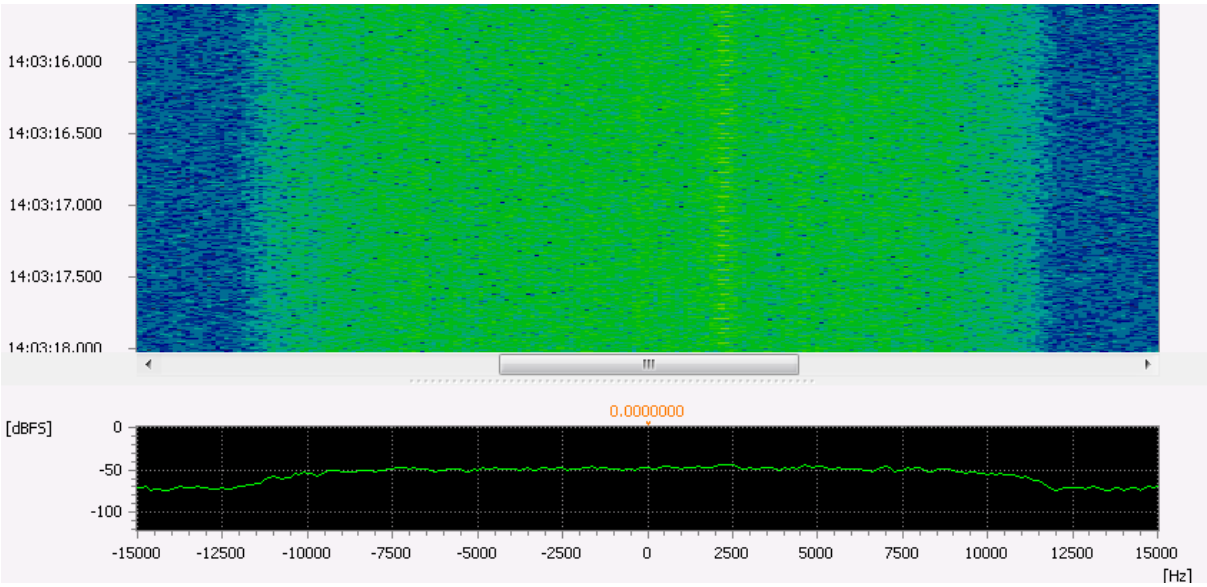


Figure 169: TETRA Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8 A/B
Symbol rate (Bd)	18000
SR tolerance (Bd)	10
Modulation order	4
Version	B
VER file name	*tetra.ver*

Table 298: TETRA Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Right now the modem does process only downlink signals.

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 299: TETRA Features

Tetrapol

General Information

Tetrapol is a digital professional mobile radio standard for digital voice and data communication. The standard has been designed by Matra and EADS corporation. Currently Tetrapol networks exist in 34 countries claiming about 70% of the European Digital PMR (Professional Mobile Radio) market.

Usage:

- Communication in the VHF/UHF frequency range among closed user groups such as public safety, military, industry and transportation.

Mode Properties

Parameter	Value
Modulation	GMSK
BT	0.25
Bandwidth (Hz)	12500
Symbol rate (Bd)	8000
Coding	FEC, encryption

Table 300: Tetrapol Characteristics

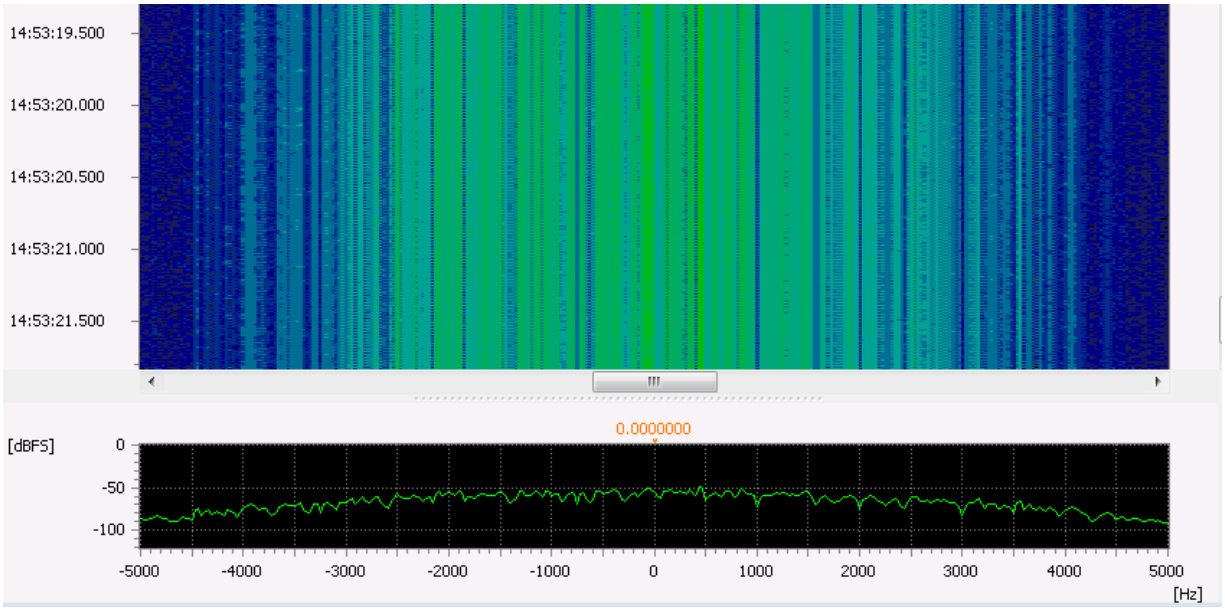


Figure 170: Tetrapol Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	(G)MSK
Type	GMSK
Symbol rate (Bd)	8000
SR tolerance (Bd)	10
BT	0.25
VER file name	*tetrapol.ver*

Table 301: Tetrapol Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 302: Tetrapol Features

VDEW

General Information

This SelCal system conforms to the VDEW (**V**ereinigung **D**eutscher **E**lektrizitaets**w**erke) recommendations (Germany). It is an analog SelCal system using a sequence of single tones.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	12
Coding	Character coding

Table 303: VDEW Characteristics

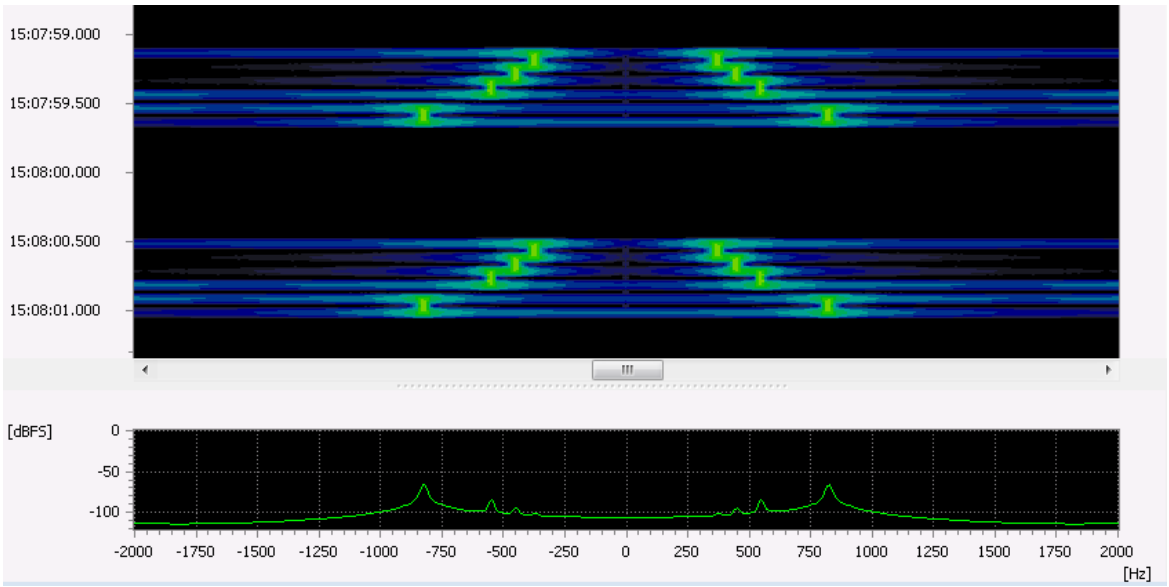


Figure 171: VDEW Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	100
TD tolerance (ms)	10
No. of tones	12
SELCAL type	VDEW
Min. burst length (s)	0.300
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	0
VER file name	*vdew.ver*

Table 304: VDEW Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 305: VDEW Features

VDL 2

General Information

The **V**HF **D**igital **L**ink (VDL) Mode **2** is an ICAO standard developed by the Aeronautical Mobile Communications Panel (AMCP) providing data communication between aircraft and ground-based systems. Aeronautical VHF data links use the band 117.975 - 137 MHz assigned by the International Telecommunication Union.

Usage:

- Data communication within the Aeronautical Telecommunication Network.

Mode Properties

Parameter	Value
Modulation	DPSK
Number of tones	8
Bandwidth (Hz)	25000
Symbol rate (Bd)	105000
Coding	Reed Solomon

Table 306: VDL 2 Characteristics

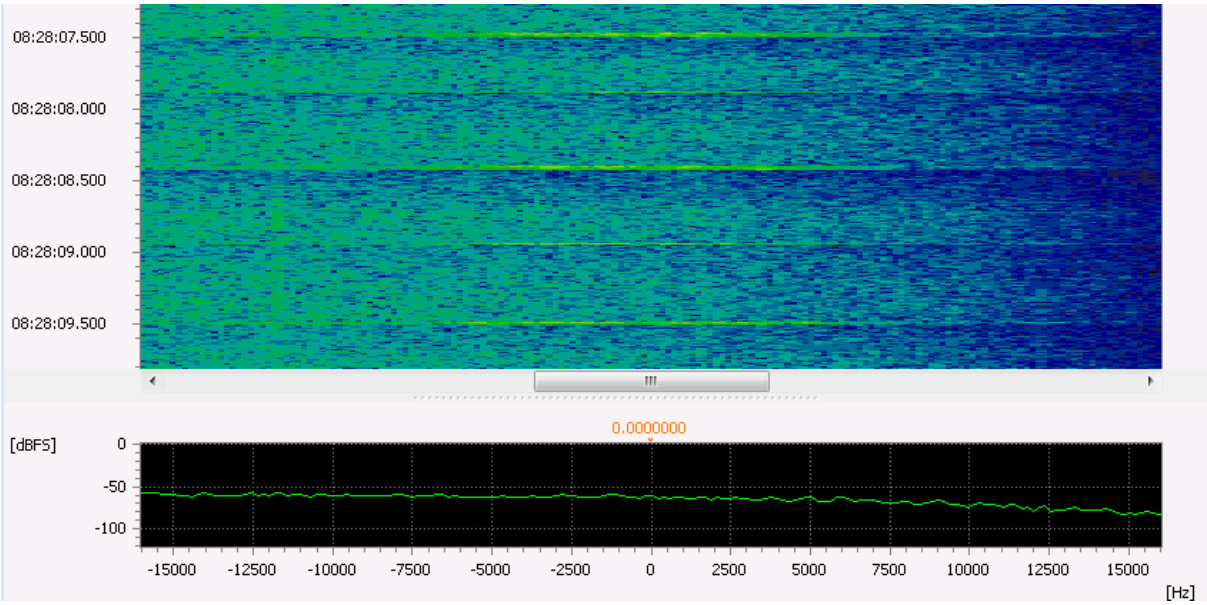


Figure 172: VDL 2 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8 A/B
Symbol rate (Bd)	10500
SR tolerance (Bd)	10
Modulation order	8
Version	A
Min. burst length (s)	0.003
Max. burst length (s)	1.000
Min. pause length (s)	0.001
Min. burst SNR (dB)	6
VER file name	*vdl2.ver*

Table 307: VDL 2 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 308: VDL 2 Features

VDL 3

General Information

The **V**HF **D**igital **L**ink (VDL) Mode **3** is an ICAO standard providing data and digitized voice communication between aircraft and ground-based systems. Ground stations assign Time Division Multiple Access (TDMA) slots for the exchange of information.

Usage:

- Data and digitized voice communication within the Aeronautical Telecommunication Network.

Mode Properties

Parameter	Value
Modulation	DPSK
Number of tones	8
Bandwidth (Hz)	25000
Symbol rate (Bd)	105000
Coding	Reed Solomon

Table 309: VDL 3 Characteristics

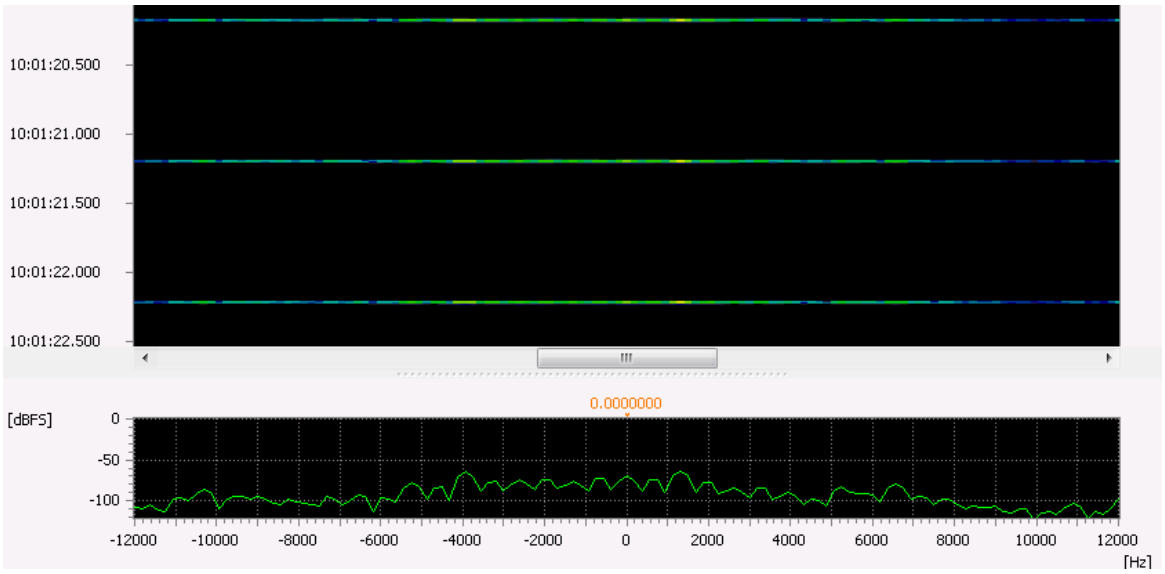


Figure 173: VDL 3 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8 A/B
Symbol rate (Bd)	10500
SR tolerance (Bd)	10
Modulation order	8
Version	A
Min. burst length (s)	0.010
Max. burst length (s)	1.000
Min. pause length (s)	0.010

Parameter	Default
Min. burst SNR (dB)	0
VER file name	*vdl3.ver*

Table 310: VDL 3 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 311: VDL 3 Features

ZVEI

General Information

This is a SelCal standard from the **Z**entral**v**erband der **E**lectrotechnischen **I**ndustrie, Germany. ZVEI I, ZVEI II, ZVEI III, DZVEI, PDZVEI and PZVEI vary only in the digit encoding.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 312: ZVEI Characteristics

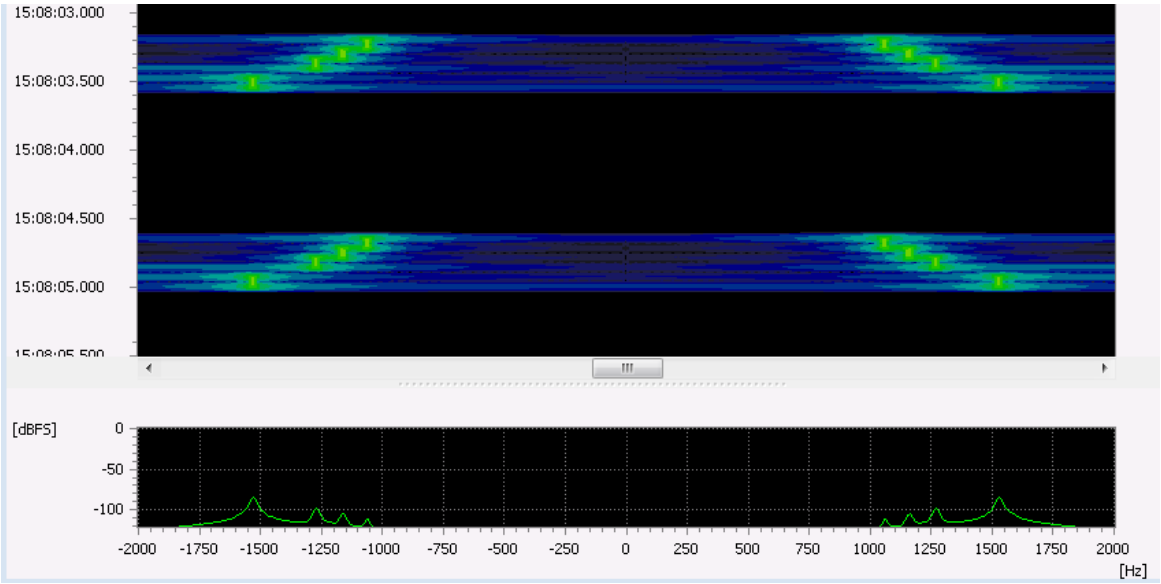


Figure 174: ZVEI Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	70
TD tolerance (ms)	15
No. of tones	19
SELCAL type	ZVEI
Min. burst length (s)	0.280
Max. burst length (s)	1.000
Min. pause length (s)	0.070
Min. burst SNR (dB)	0
VER file name	*zvei.ver*

Table 313: ZVEI Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 314: ZVEI Features

Premium Decoders

Version History

Release	Date	Editor	History
2.0.0	2013-01-10		Added : ALE-2G CHN 4plus4 (Detection only) HC-ARQ Link11 SLEW MIL-STD-188-110B 39Tones MIL-M-55529A STANAG-4295 STANAG-4481 (FSK + PSK) STANAG-4529 STANAG-4539 (incl HDR) STANAG-5065
2.1.0	2013-07-31	MBu	Added : LINK11 CLEW MIL-STD 188-110 (16T + 39T) STANAG-4197

Installation

go2MONITOR / CMAS

This description refers to go2MONITOR version 1.2.0. If required adapt it to your actual version.

Automatic

- Double-Click on “Setup of Premium Decoders 2.1 (go2MONITOR 1.2.0)” and follow the installation procedure.
- When asked for the installation folder, please change it to go2MONITOR m.m.m or your actual location of go2MONITOR or CMAS.
- Check whether the **.bin*-files have been copied to c:\Program Files (x86)\go2SIGNALS\go2MONITOR m.m.m\decoders\.

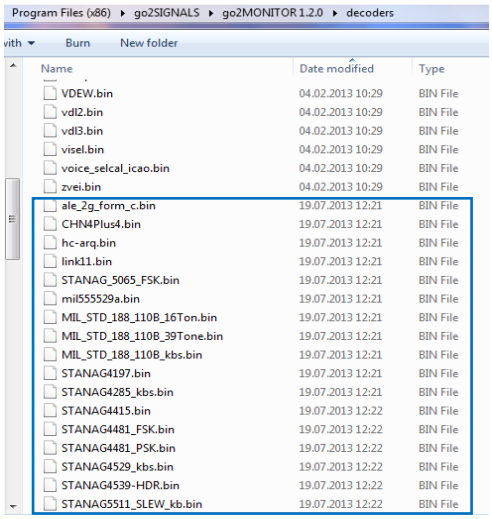


Figure 175: go2MONITOR Decoder Directory

- Check whether the **.ver*-files have been copied to c:\Program Files (x86)\go2SIGNALS\go2MONITOR m.m.m\modems\.

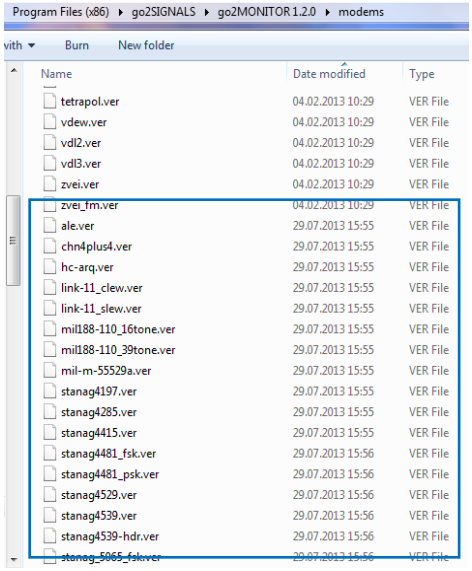


Figure 176: go2MONITOR Modem Directory

- Start go2MONITOR now. Select “All Modems” in “Recognition + Decoding”. Check whether MIL and STANAG modems are available.
- Modify/Create your own modem lists, add the required modems.

Manual

- Select in the Premium Decoder package the code directory (e.g. \Build 2013-01-07\data\applications\code\ ) and copy all files to c:\Program Files (x86)\go2SIGNALS\go2MONITOR m.m.m\decoders\.
- From **each** subdirectory of f:\Build 2013-01-07\data\Signals\Premium\ copy the *ver*-files to c:\Program Files (x86)\go2SIGNALS\go2MONITOR m.m.m\modems\.
- Start go2M now. Select “All Modems” in “Recognition + Decoding”. Check whether MIL and STANAG are available.
- Modify your own modem lists, add the required modems.

go2DECODE / PROCEED

This description refers to go2DECODE version 3.4.0. If required adapt it to your actual version.

- Double-Click on “Setup of Premium Decoders 2.1 (go2DECODE 3.4.0)” and follow the installation procedure.
- If asked for the installation folder, please change it to go2DECODE n.n.n or your actual location of go2DECODE or PROCEED.
- Check whether the *.*bin*-files have been copied to c:\Program Files (x86)\go2SIGNALS\go2DECODE n.n.n\applications\code\

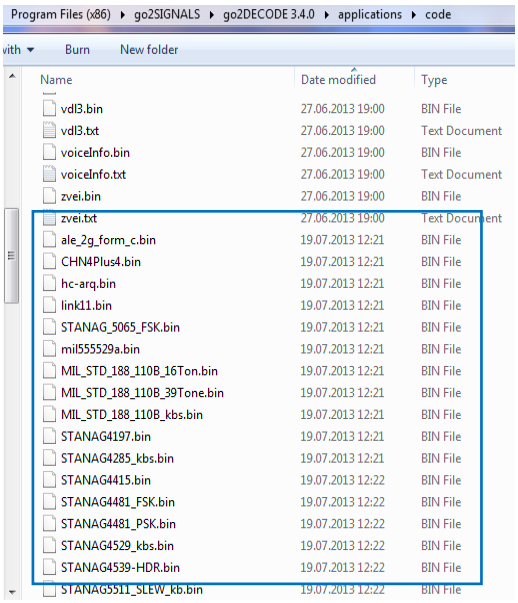


Figure 177: go2DECODE Code Directory

- Check c:\Program Files (x86)\go2SIGNALS\go2DECODE n.n.n\modems\Premium\ for new sub-directories like stanag4285, stanag4539 etc. Each directory should contain a *.ver* file.

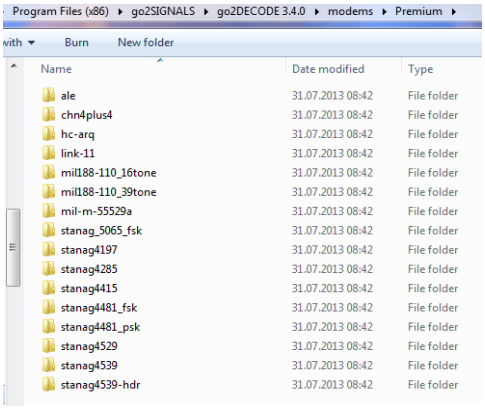


Figure 178: go2DECODE Premium Modem Directory

- Check whether the *.ver*-files have been copied to C:\ProgramFiles(x86)\go2SIGNALS\go2DECODE n.n.n\modems\Premium\xxx\
- Start go2DECODE now. Stop decoding.
- Add now all the required Premium Decoders to you modem list.
  Select “Modem”, “Load Modem from file” add i.e.
  …\go2DECODE n.n.n\modems\Premium\stanag4285\ *stanag4285.ver*
- Or just drag and drop the *.ver*-file to the modem list.

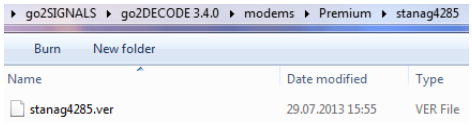


Figure 179: STANAG4285 Directory

- If you exit the application you will be asked whether the new modem list has to be stored.

Remarks: bin files located in c:\Users\<user>\go2SIGNALS\go2DECODE n.n\code\ are used if available. Also modified files are stored in this directory.

Available Decoders

ALE-2G

General Information

Automatic Link Establishment second generation is based on the standard **MIL-STD 188-141A**.
This system is used to detect and assign the HF-channel which is considered most reliable for data-communication at the given time.

Usage:

- Detection of the HF-channel best suited for data-transfer between two stations.

Mode Properties

Parameter	Value
Modulation	FSK
Tones	8
Shift (Hz)	250
Bandwidth	2000
Symbol rate (Baud)	125
Data rate (bit/s)	375
Alphabet	ITA5

Table 315: ALE-2G Characteristics

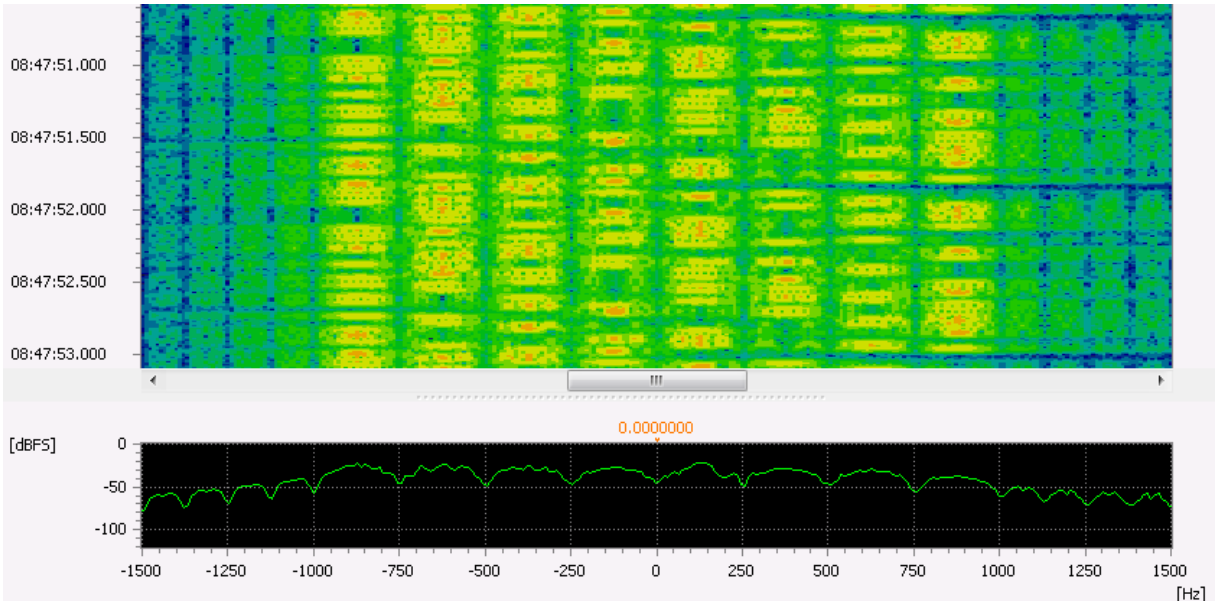


Figure 180: ALE-2G Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (FSKn)
Number of tones	8
Tone duration (ms)	8
TD tolerance (ms)	0.050
Tone position type	Equidistant frequencies
Tone distance (Hz)	250
VER file name	ale.ver

Table 316: ALE-2G Demodulator Settings

Tuning

- The tuning frequency is midway between channels 4 and 5.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 317: ALE-2G Features

CHN 4plus4

General Information

CHN 4+4 is a mode assumedly used by the Chinese military.
It is based on two groups, with a 450 Hz gap, of 4 tones with 300 Hz spacing.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	QPSK
Tones	2 x 4
Channel distance (Hz)	300 / 450
Bandwidth	3000
Symbol rate (Bd) (per channel))	75
Data rate (bit/s)	1200

Table 318: CHN 4plus4 Characteristics

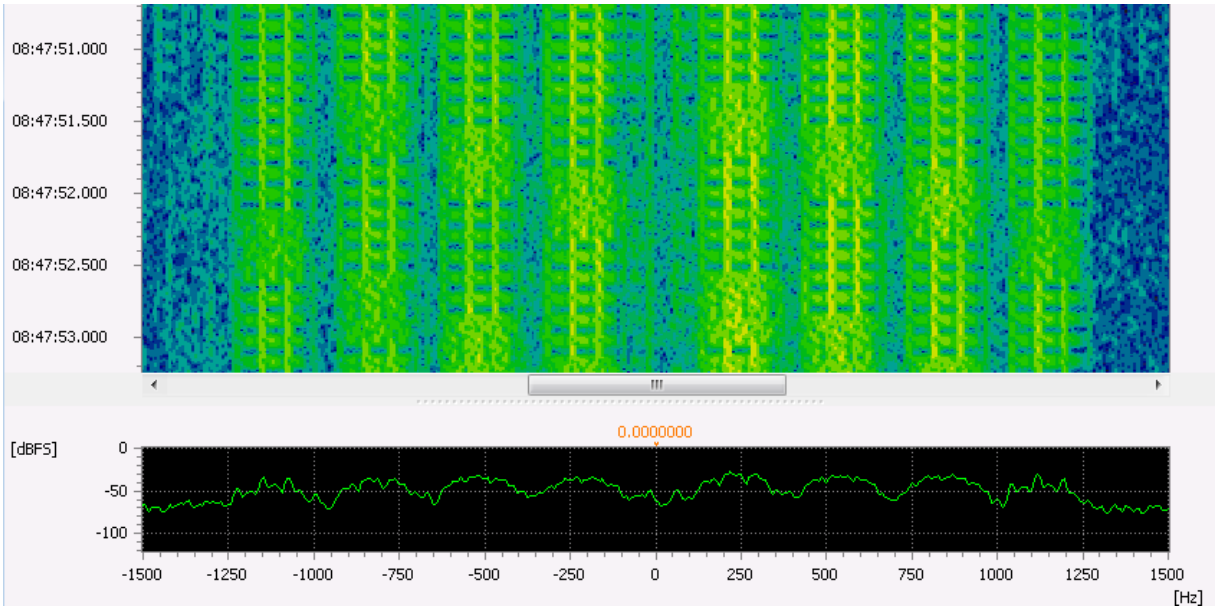


Figure 181: CHN 4plus4 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	MPSK 2,4,8 A/B
Symbol rate (Baud)	75
SR tolerance (Baud)	1
Modulation order	4
Version	B
Number of channels	8
Channel position type	Channel frequencies
Channel distance (Hz)	450
VER file name	Chn4plus4.ver

Table 319: CHN 4plus4 Demodulator Settings

Tuning

- The tuning frequency is midway between channels 4 and 5.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 320: CHN 4plus4 Features

HC-ARQ

General Information

Hagelin Crypto ARQ is a synchronous simplex ARQ system (no longer) used by UN and IRC.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Tones	2
Shift (Hz)	200
Bandwidth (Hz)	300
Symbol rate (Baud)	240
Alphabet	ITA-2

Table 321: HC-ARQ Characteristics

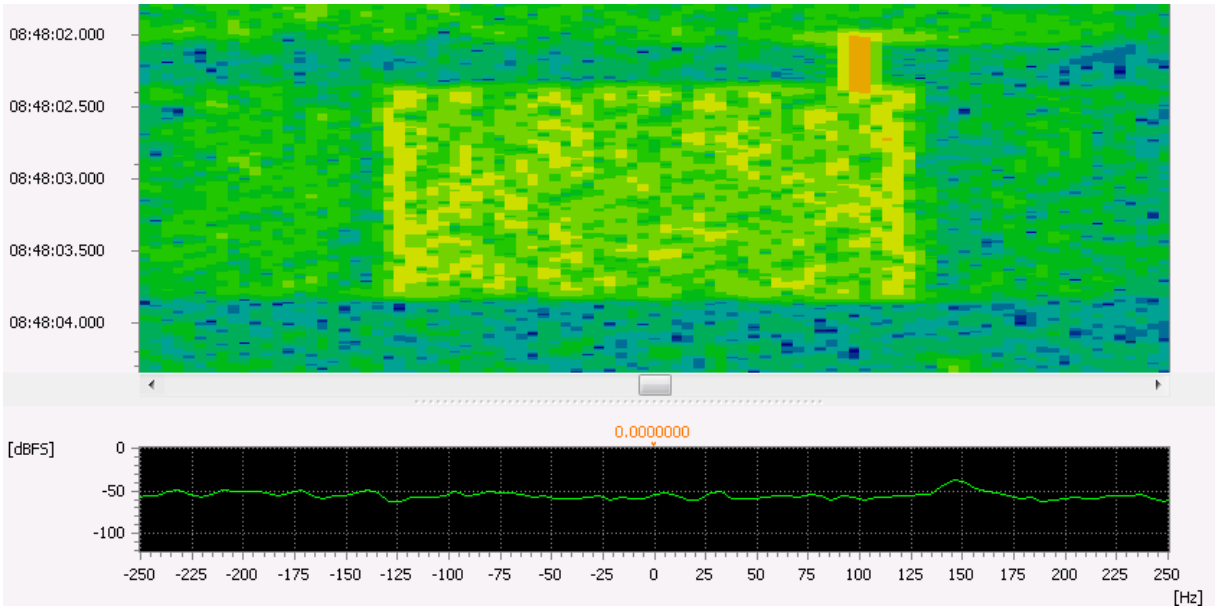


Figure 182: HC-ARQ Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Baud)	240
SR tolerance (Baud)	0
Modulation order	2
Shift (Hz)	200
Shift tolerance (Hz)	48
Modem type	Synchronous
VER file name	hc-arq.ver

Table 322: HC-ARQ Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 323: HC-ARQ Features

LINK 11 CLEW

General Information

STANAG5511 CLEW mode is a NATO Standard for tactical data exchange. The Conventional Link Eleven Waveform (CLEW) is one of the modes defined within the Link 11 NATO Standard.

Usage:

- Transfer of tactical data over HF and VHF.

Mode Properties

Parameter	Value
Modulation	DQPSK
Tones	16
Bandwidth (Hz)	2500
Data rate (bit/s)	1364, 2250

Table 324: LINK 11 CLEW Characteristics

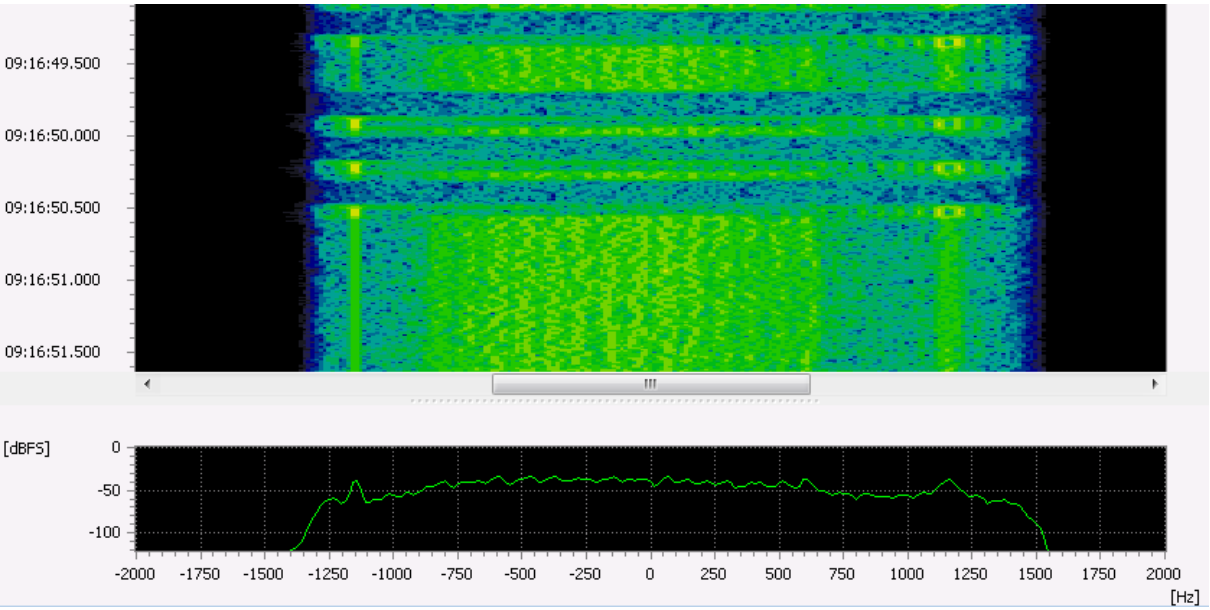


Figure 183: LINK 11 CLEW Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Link-11
VER file name	link-11_clew.ver

Table 325: LINK 11 CLEW Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 326: LINK 11 CLEW Features

LINK 11 SLEW

General Information

STANAG5511 SLEW mode is a NATO Standard for tactical data exchange. The Single Tone Link Eleven Waveform (SLEW) is one of the modes defined within the Link 11 NATO Standard.

Usage:

- Transfer of tactical data over HF and VHF.

Mode Properties

Parameter	Value
Modulation	PSK
Tones	8
Bandwidth (Hz)	3000
Symbol rate (Baud)	2400
Coding	Convolutional

Table 327: LINK 11 SLEW Characteristics

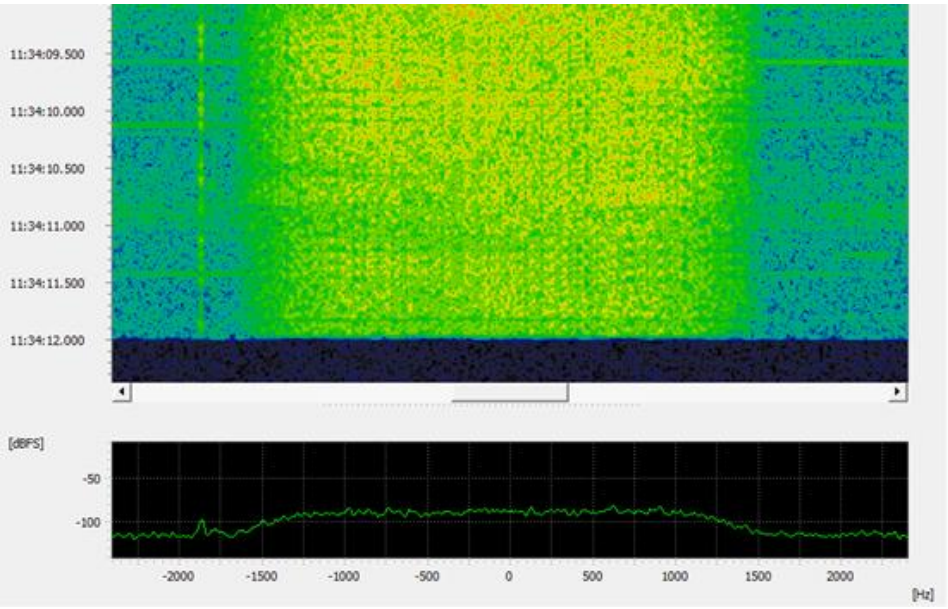


Figure 184: LINK 11 SLEW Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	PSK data added
Symbol rate (Baud)	2400
SR tolerance (Baud)	5
Modulation order	8
Min. burst length (s)	0.100
Max. burst length (s)	2.000
Min. pause length (s)	0.004
VER file name	link-11_slew.ver

Table 328: LINK 11 SLEW Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes

Feature	Status
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 329: LINK 11 SLEW Features

MIL-M-55529A

General Information

MIL-M-55529A is a synchronous FSK mode built into GRC-MD522 teletypewriter sets. This mode is also known as MD-522 (NB/WB).

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value	
Modulation	FSK	
Tones	2	
	NB	WB
Shift (Hz)	85	850
Bandwidth (Hz)	200	1000
Center Frequency (Hz)	2804	2000
Symbol rate (Baud)	50, 75, 100, 110	
Data rate (bit/s)	28, 42 55, 61	32, 48 64, 70
Alphabet	ITA2, ITA5	

Table 330: MIL-M-55529A Characteristics

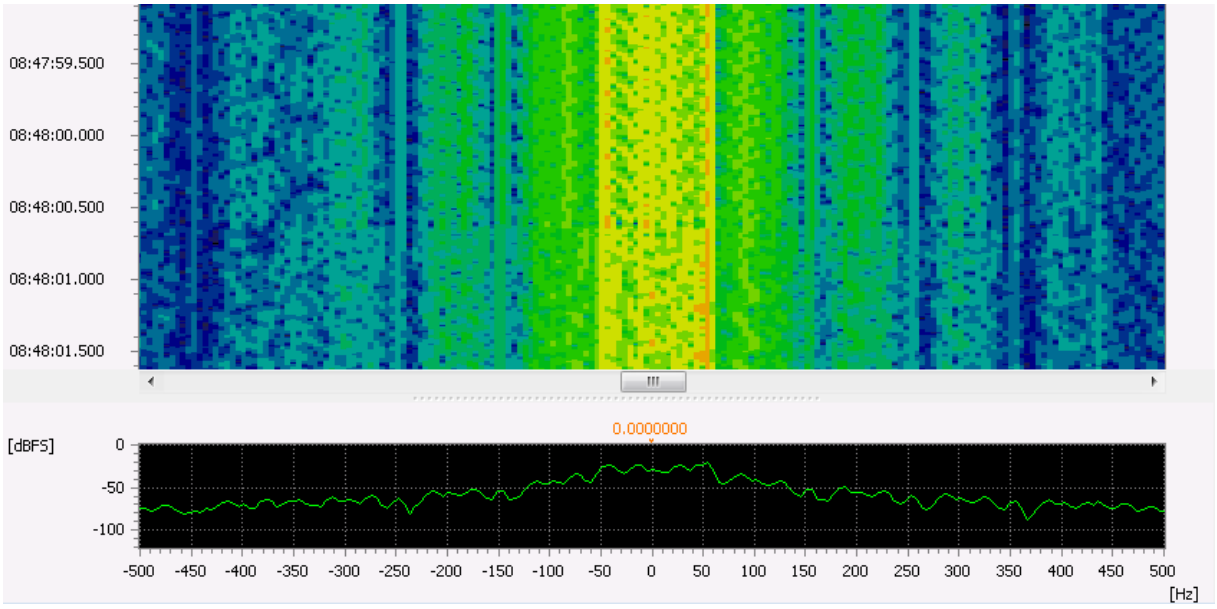


Figure 185: MIL-M-55529A Spectrogram

Demodulator Settings

Parameter	NB	WB
Demodulator	FSK 2 matched	
Symbol rate (Baud)	100	
SR tolerance (Baud)	10	
Shift (Hz)	85	850
Modem type	Synchronous	
Min. burst length (s)	0.100	
Max. burst length (s)	1.000	
Min. pause length (s)	0.100	
VER file name	mil55529a.ver	

Table 331: MIL-M-55529A Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 332: MIL-M-55529A Features

MIL-STD-188-110B 16Tone

General Information

MIL-STD-188-110B-16Tone is a parallel mode which uses 16 subcarrier tones in the audio frequency band with differential phase shift keying (DPSK) modulation for bit synchronous data transmission. The modulation rate of the modulator output is constant for all data rates. The system supports data rates of 75 to 2400 bps.

Usage:

- Data communication over HF between departments and agencies of the DoD.

Mode Properties

Parameter	Value
Modulation	DPSK
Number of tones	16
Bandwidth (Hz)	2500
Symbol rate (Baud)	75
Data rate (bit/s)	75 … 2400

Table 333: MIL-STD-188-110B 16Tone Characteristics

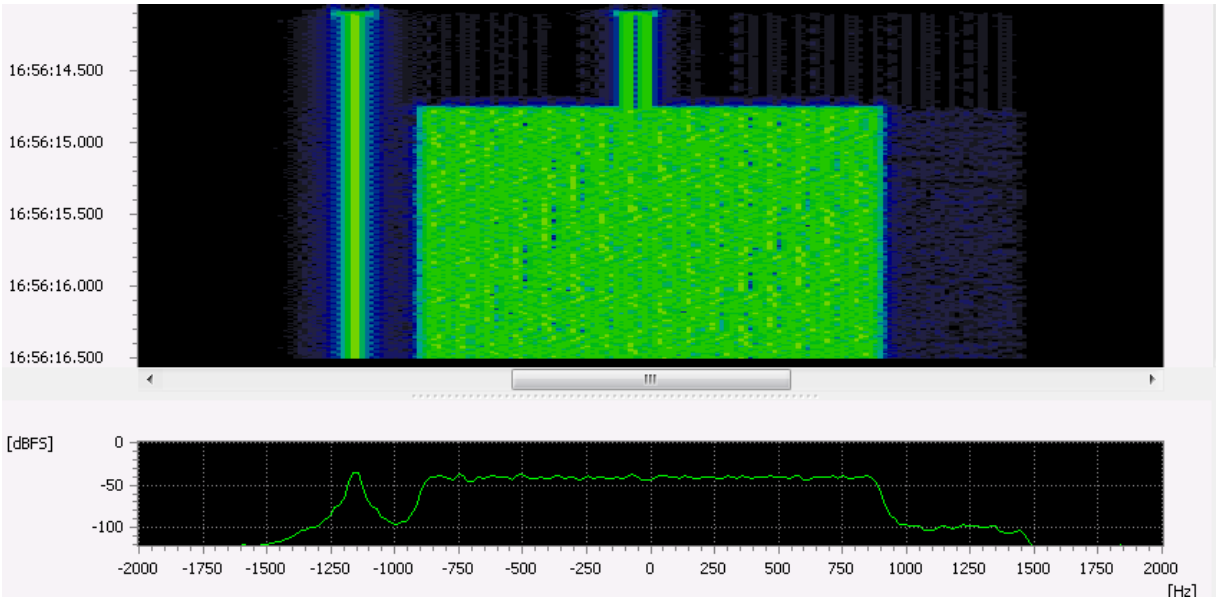


Figure 186: MIL-STD-188-110B 16Tone Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	MDPSK 2,4,8,16 A/B
Symbol rate (Baud)	75
SR tolerance (Baud)	1
Modulation order	4
Version	B
No. of channels	16
Channel position type	Channel distance
Channel distance (Hz)	110
Min. burst length (s)	0.100
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	0
VER file name	mil188-110_16tone.ver

Table 334: MIL-STD-188-110B 16Tone Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 335: MIL-STD-188-110B 16Tone Features

MIL-STD-188-110B 39Tone

General Information

MIL-STD-188-110B-39Tone is a parallel mode which uses 39 orthogonal subcarrier tones in the audio frequency band with quadrature differential phase shift keying (QDPSK) modulation for bit synchronous data transmission. The modulation rate of the modulator output is constant for all data rates. The system supports data rates of 75 to 2400 bps.

Usage:

- Data communication over HF between departments and agencies of the DoD.

Mode Properties

Parameter	Value
Modulation	QDPSK
Number of tones	1 + 39
Bandwidth (Hz)	2500
Symbol rate (Baud)	44.44
Data rate (bit/s)	75 … 2400
Coding	Reed Solomon

Table 336: MIL-STD-188-110B 39Tone Characteristics

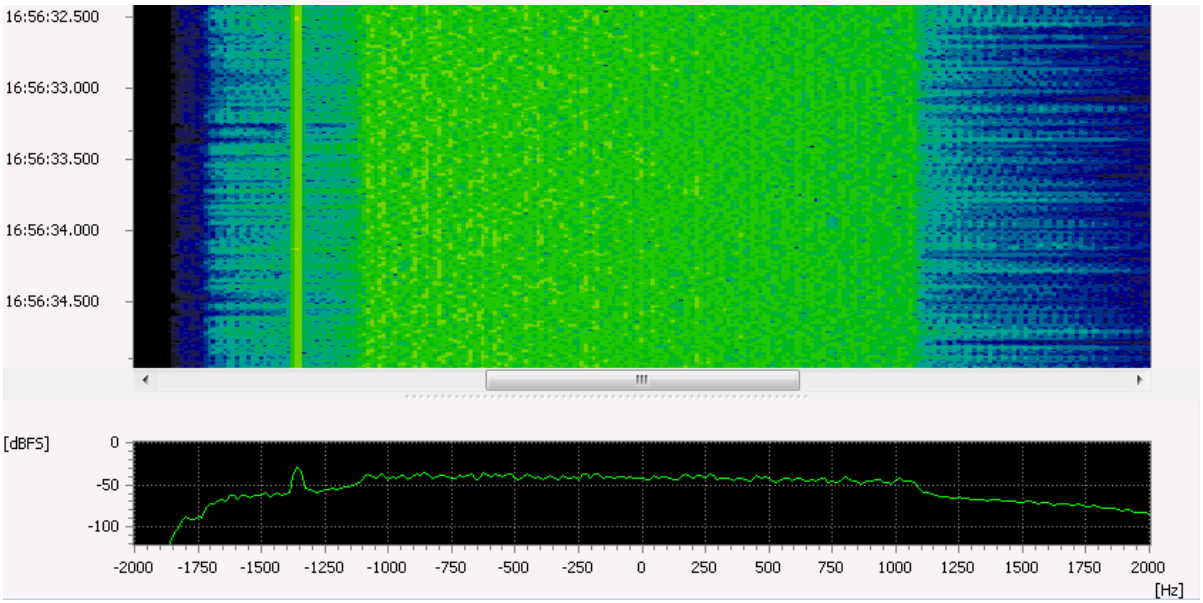


Figure 187: MIL-STD-188-110B 39Tone Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	OFDM
Symbol rate (Baud)	44.44
No. of channels	39
Channel distance (Hz)	56.250

Parameter	Default
Constellation	DPSK-4B
Min. burst length (s)	0.200
Max. burst length (s)	0.000
Min. pause length (s)	0.050
Min. burst SNR (dB)	0
VER file name	mil188-110_39tone.ver

Table 337: MIL-STD-188-110B 39Tone Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 338: MIL-STD-188-110B 39Tone Features

STANAG-4197

General Information

STANAG 4197 is a mode for the exchange of voice-data, which are coded according to the LPC10 (Linear Predictive Coding) standard, over a radio channel in a robust way.

Usage:

- Military voice communication over HF.

Mode Properties

Parameter	Value
Modulation	QPSK
Tones	39
Shift (Hz)	56.25
Bandwidth (Hz)	2300
Symbol rate (Baud)	2400
Data rate (bit/s)	44.44
Error correction	FEC

Table 339: STANAG-4197 Characteristics

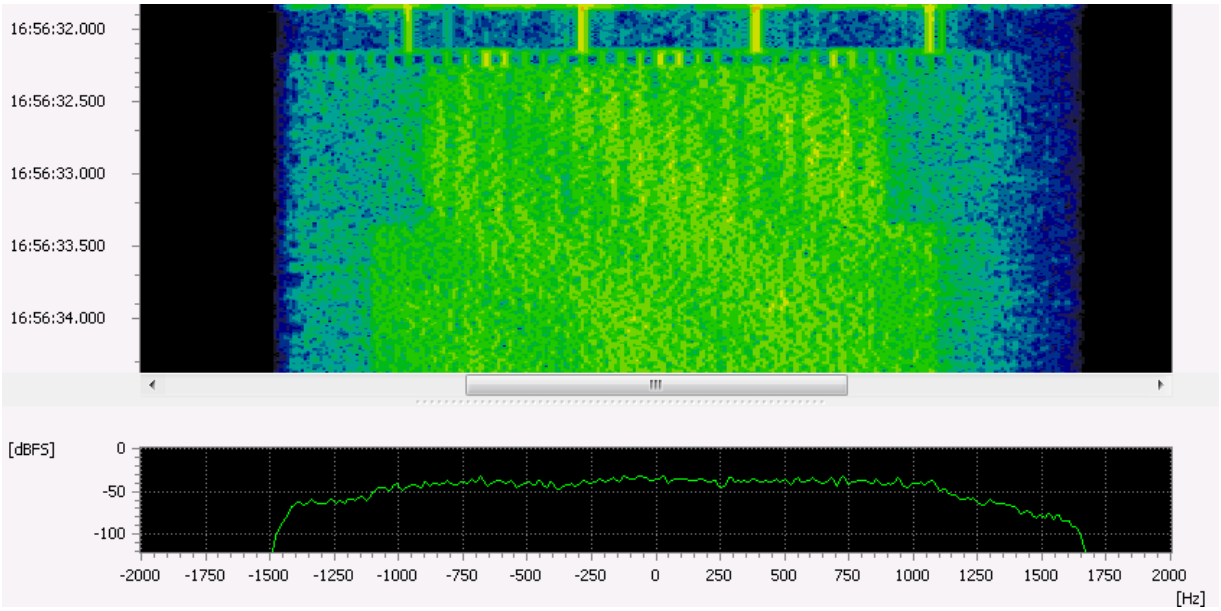


Figure 188: STANAG-4197 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	OFDM
Symbol rate (Baud)	44.444
No. of channels	39
Channel distance (Hz)	56.250
Constellation	PSK 4A
Min. burst length (s)	0.200
Max. burst length (s)	0.000
Min. pause length (s)	0.050
VER file name	stanag4197.ver

Table 340: STANAG-4197 Demodulator Settings

Tuning

- The center frequency is 1800 Hz.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 341: STANAG-4197 Features

STANAG-4285

General Information

STANAG-4285 is a NATO standard for digital data communication.

Usage:

- Transfer of digital information over HF.

Mode Properties

Parameter	Value								
Symbol rate (Baud)	2400								
Bandwidth (Hz)	3000								
Data rate (bit/s)	75	150	300	600	1200	2400	1200	2400	3600
Modulation	BPSK	BPSK	BPSK	BPSK	QPSK	8PSK	BPSK	QPSK	8PSK
Error correction	CR 1/16	CR 1/8	CR 1/4	CR 1/2	CR 2/3	none	none	none	none
Interleaving	Short/ Long	Short/ Long	Short/ Long	Short/ Long	Short/ Long	none	none	none	none

Table 342: STANAG-4285 Characteristics

Short interleaver: 0.852 s
Long interleaver: 10.240 s

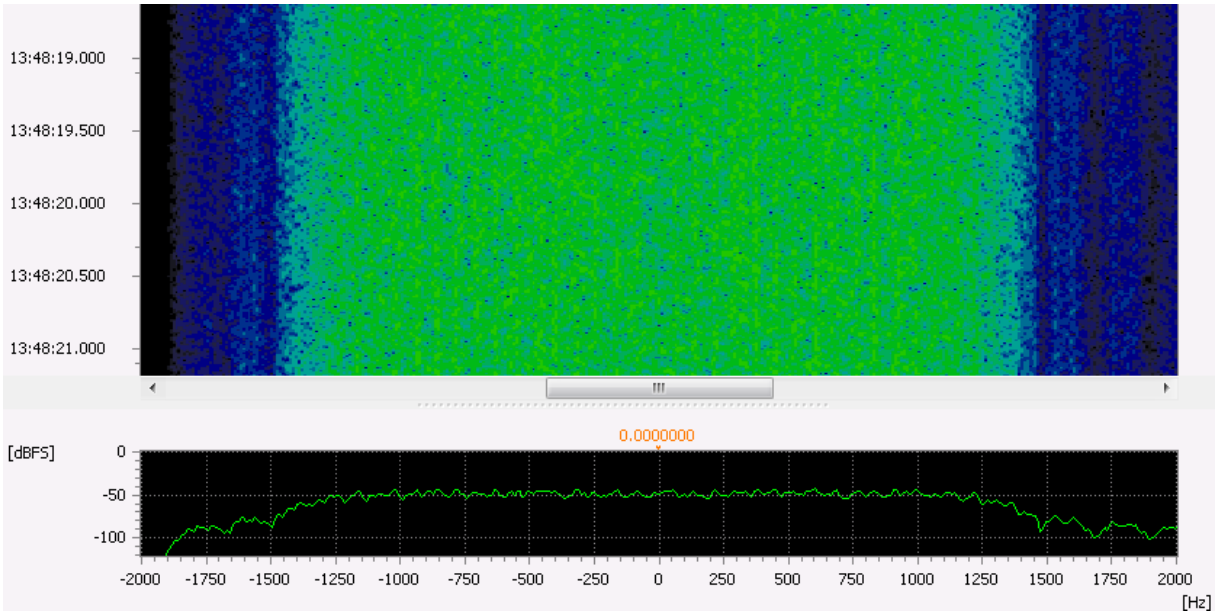


Figure 189: STANAG-4285 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	KB-PSK
Symbol rate (Baud)	2400
SR tolerance	12

Parameter	Default
Modulation order	8
Version	A
Min. burst length (s)	0.100
Max. burst length (s)	1.000
Min. pause length (s)	0.100
VER file name	stanag4285_kb.ver

Table 343: STANAG-4285 Demodulator Settings

Tuning

- The center frequency is 1800 Hz.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 344: STANAG-4285 Features

STANAG-4415

General Information

STANAG is a NATO standard for robust, non-hopping digital data communication.
It is equivalent to the 75 bps variant of MIL-STD-188-110 A/B single mode.

Usage:

- Transfer of digital information over HF.

Mode Properties

Parameter	Value
Modulation	8PSK
Bandwidth (Hz)	3000
Symbol rate (Baud)	2400
Data rate (bit/s)	75
Error correction	FEC rate 1/2
Interleaver (s)	0, 0.6, 4.8

Table 345: STANAG-4415 Characteristics

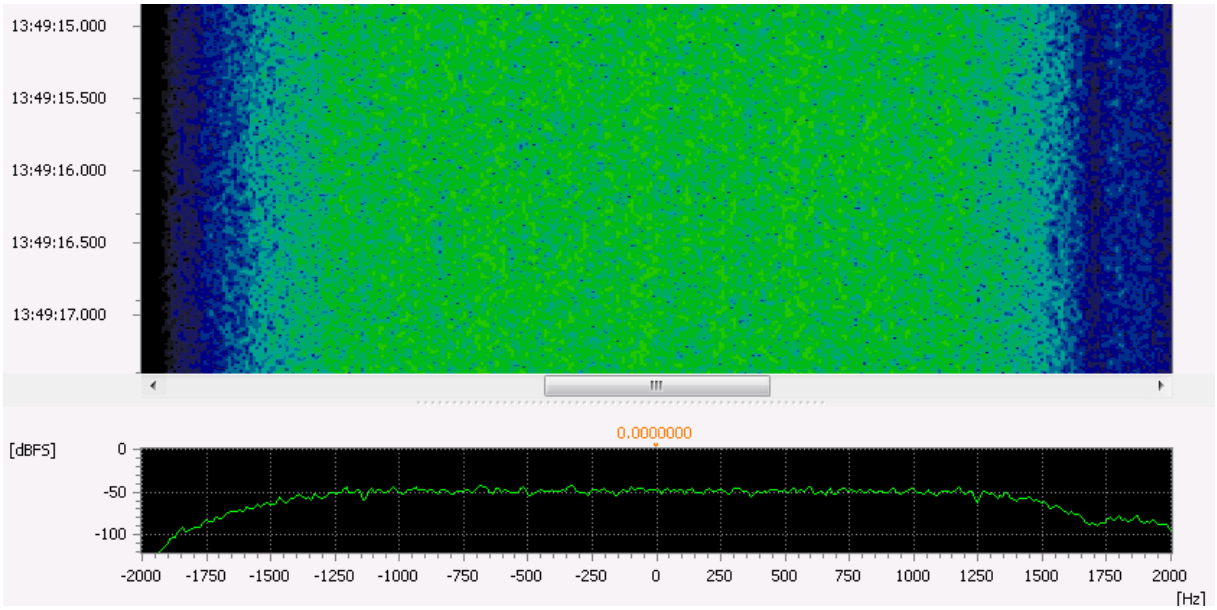


Figure 190: STANAG-4415 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	PSK 2,4,8 A/B
Symbol rate (Baud)	2400
SR tolerance (Baud)	20
Modulation order	8
Version	A
Min. burst length (s)	0.100
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	0
VER file name	stanag4415.ver

Table 346: STANAG-4415 Demodulator Settings

Tuning

- The center frequency is 1800 Hz.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 347: STANAG-4415 Features

STANAG-4481

General Information

STANAG-4481is a NATO standard for maritime shore-to-ship broadcast digital data communication. Data are sent by a single land-based transmitting station and received by many stations aboard ships.

There are two variants, one with a FSK modulated signal, the other with PSK modulation.

Usage:

- Transfer of maritime related digital information over HF.

Mode Properties

Parameter	Value	
Modulation	FSK	BPSK
Tones	2	-
Shift (Hz)	850	-
Bandwidth (Hz)	1500	3000
Symbol rate (Baud)	75, 100, 150, 300, 600	2400
Data rate (bit/s)	-	300
Error correction	-	FEC rate 1/4

Table 348: STANAG-4481 Characteristics

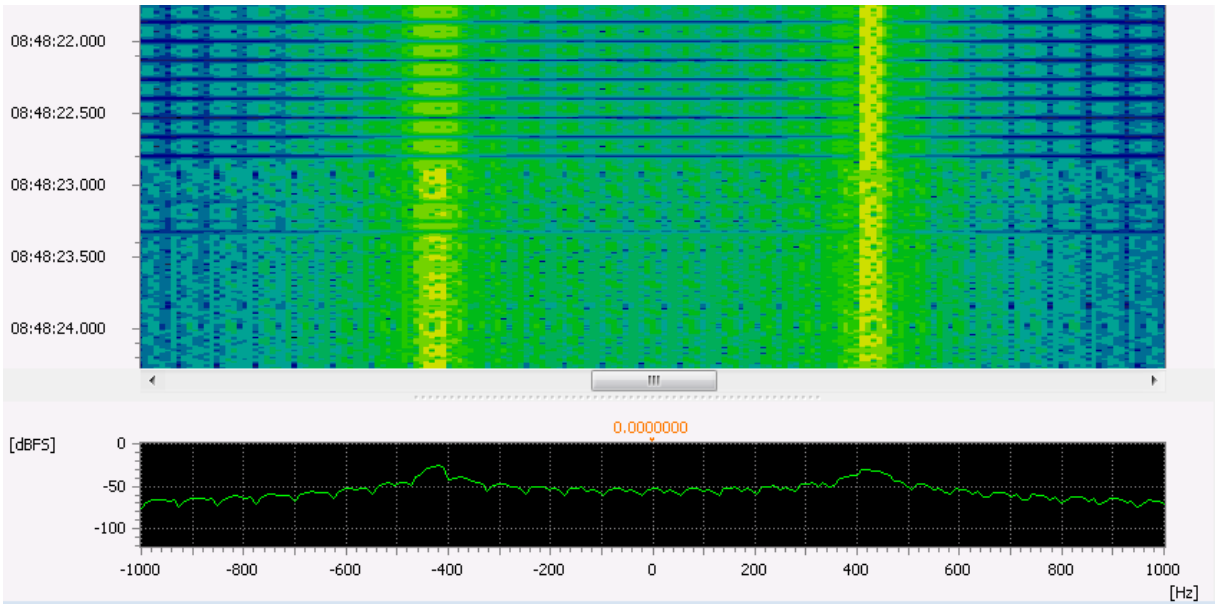


Figure 191: STANAG-4481 FSK Spectrogram

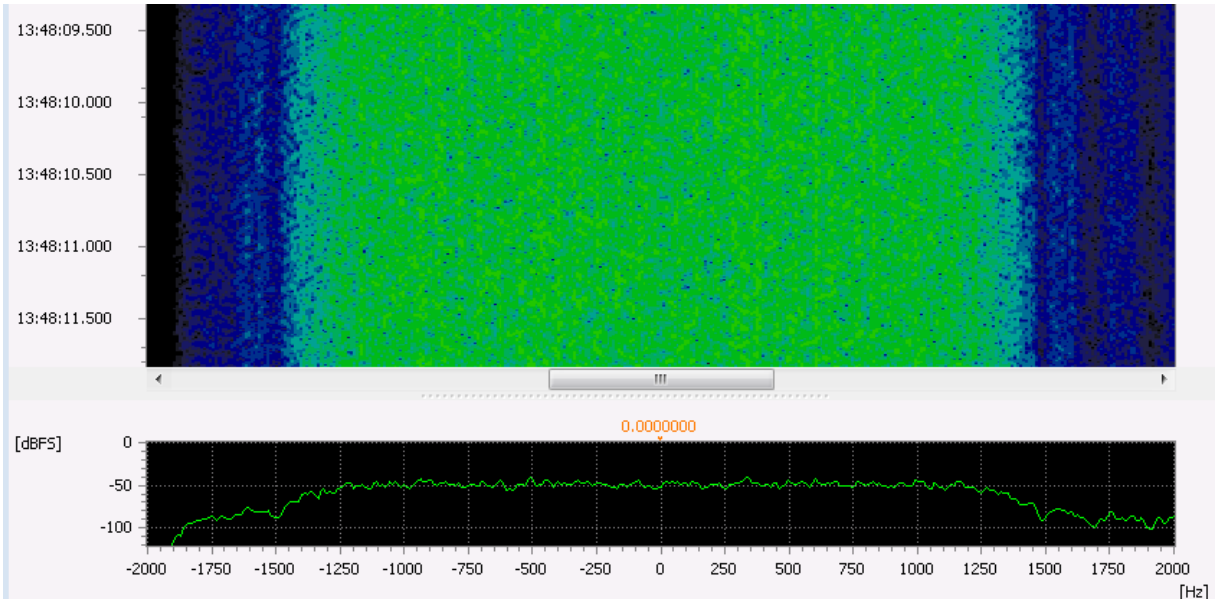


Figure 192: STANAG-4481 PSK Spectrogram

Demodulator Settings

Parameter	FSK	PSK
Demodulator	FSK 2 matched	KB-PSK
Symbol rate (Baud)	75	2400
SR tolerance (Baud)	5	24
Shift (Hz)	850	-
Shift tolerance (Hz)	10	-
Modulation order	-	8
Version	-	A
Min. burst length (s)	0.100	0.100
Max. burst length (s)	1.000	1.000
Min. pause length (s)	0.100	0.100
VER file name	stanag4481_fsk.ver	stanag4481_psk.ver

Table 349: STANAG-4481 Demodulator Settings

Tuning

Tuning frequency in case of FSK is the center frequency between mark and space frequency.
Tuning frequency in case of PSK is 1800 Hz.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 350: STANAG-4481 Features

STANAG-4529

General Information

STANAG-4529 is a NATO standard for secure maritime digital data communication with data rates ranging from 75 to 1800 bit/s.

Usage:

- Transfer of maritime related digital information over HF.

Mode Properties

Parameter	Value							
Symbol rate (Baud)	1200							
Bandwidth (Hz)	1300							
Data rate (bit/s)	75	150	300	600	1200	600	1200	1800
Modulation	BPSK	BPSK	BPSK	BPSK	QPSK	8PSK	BPSK	8PSK
Error correction	CR 1/8	CR 1/4	CR 1/2	CR 1/2	CR 2/3	none	none	none
Interleaving	Short/ Long	Short/ Long	Short/ Long	Short/ Long	Short/ Long	none	none	none

Table 351: STANAG-4529 Characteristics

Short interleaver: 1.706 s

Long interleaver: 20.480 s

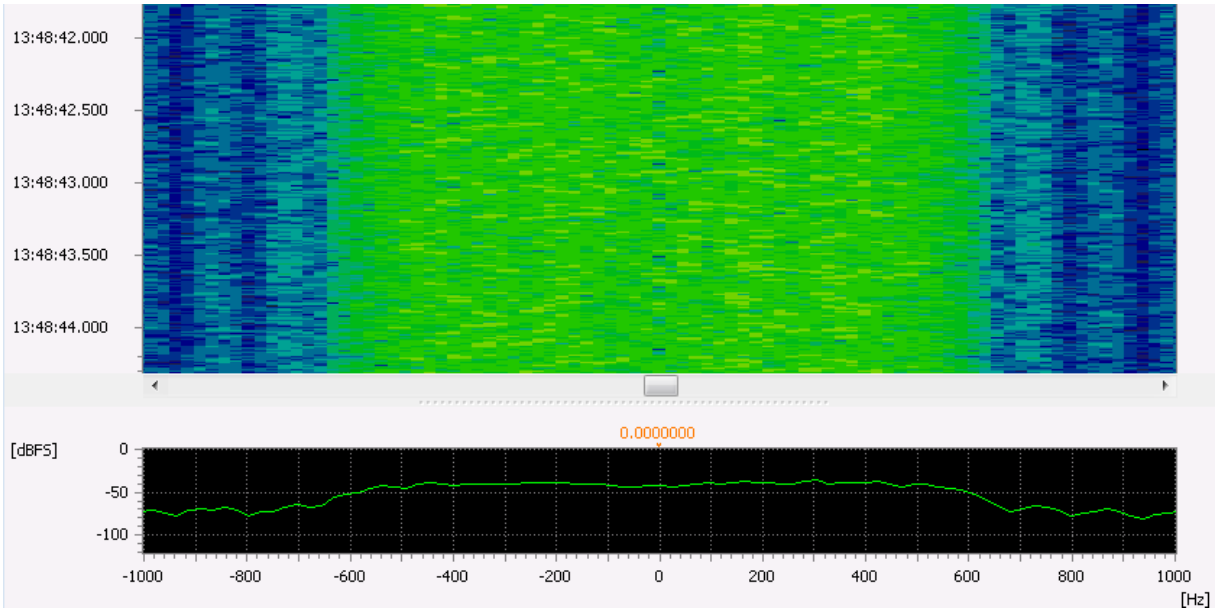


Figure 193: STANAG-4529 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	KB-PSK
Symbol rate (Baud)	1200
SR tolerance (Baud)	6
Modulation order	8

Parameter	Default
Version	A
Min. burst length (s)	0.100
Max. burst length (s)	1.000
Min. pause length (s)	0.100
VER file name	stanag4529_kb.ver

Table 352: STANAG-4529 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 353: STANAG-4529 Features

STANAG-4539

General Information

STANAG-4539 is a NATO standard for digital data communication.
It is equivalent to MIL-STD-188-110 A/B single mode.

Usage:

- Transfer of digital information over HF.

Mode Properties

Parameter	Value
Modulation	QPSK, 8PSK, 16QAM, 32QAM, 64QAM
Bandwidth (Hz)	3000
Symbol rate (Baud)	2400
Data rate (bit/s)	3200 / 4800 / 6400 / 8000 / 9600
Error correction	FEC, code rate 3/4

Table 354: STANAG-4539 Characteristics

Short interleaver: 0.12 s
Long interleaver: 8.64 s

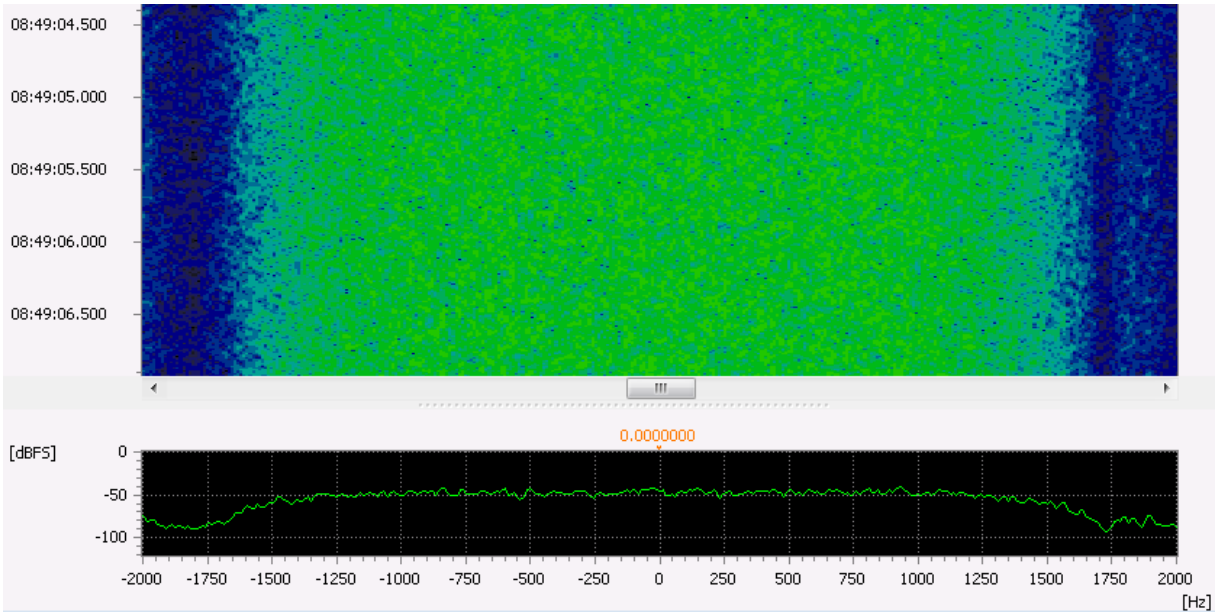


Figure 194: STANAG-4539 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	KB-PSK
Symbol rate (Baud)	2400
SR tolerance (Baud)	20
Modulation order	8
Version	A
Min. burst length (s)	0.100
Max. burst length (s)	1.000
Min. pause length (s)	0.100
VER file name	stanag4539.ver

Table 355: STANAG-4539 Demodulator Settings

Tuning

- The tuning frequency is 1800 Hz.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 356: STANAG-4539 Features

STANAG-4539 HDR

General Information

STANAG-4539 is a NATO standard for digital data communication.
The HDR variant is equivalent to MIL-STD-188-110 B appendix C mode.

Usage:

- Transfer of digital information over HF.

Mode Properties

Parameter	Value
Modulation	QPSK, 8PSK, 16QAM, 32QAM, 64QAM
Bandwidth (Hz)	3000
Symbol rate (Baud)	2400
Data rate (bit/s)	3200 / 4800 / 6400 / 8000 / 9600 / 12800
Error correction	FEC, code rate 3/4

Table 357: STANAG-4539 HDR Characteristics

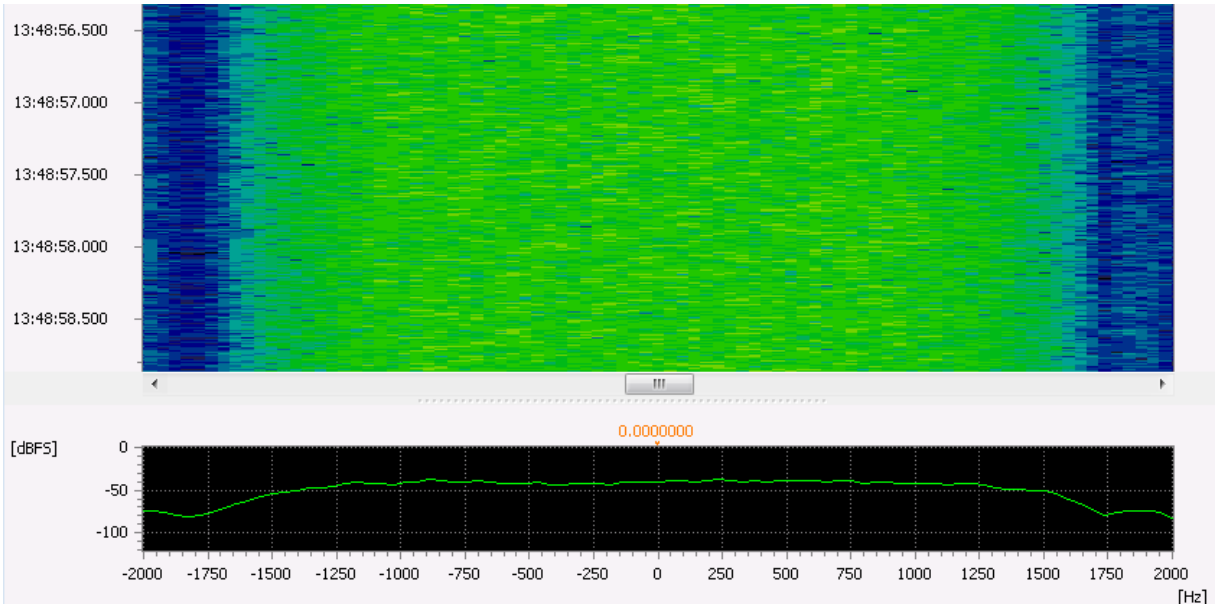


Figure 195: STANAG-4539 HDR Spectrogram

STANAG-5065

General Information

STANAG-5065 is a NATO standard for maritime digital data communication with low data rates on low frequencies.

Usage:

- Transfer of maritime related textual information over LF.

Mode Properties

Parameter	Value
Modulation	FSK
Tones	2
Shift (Hz)	85 /170
Bandwidth (Hz)	200
Symbol rate (Baud)	50 / 75 / 100 / 150
Alphabet	ITA2, ITA5

Table 358: STANAG-5065 Characteristics

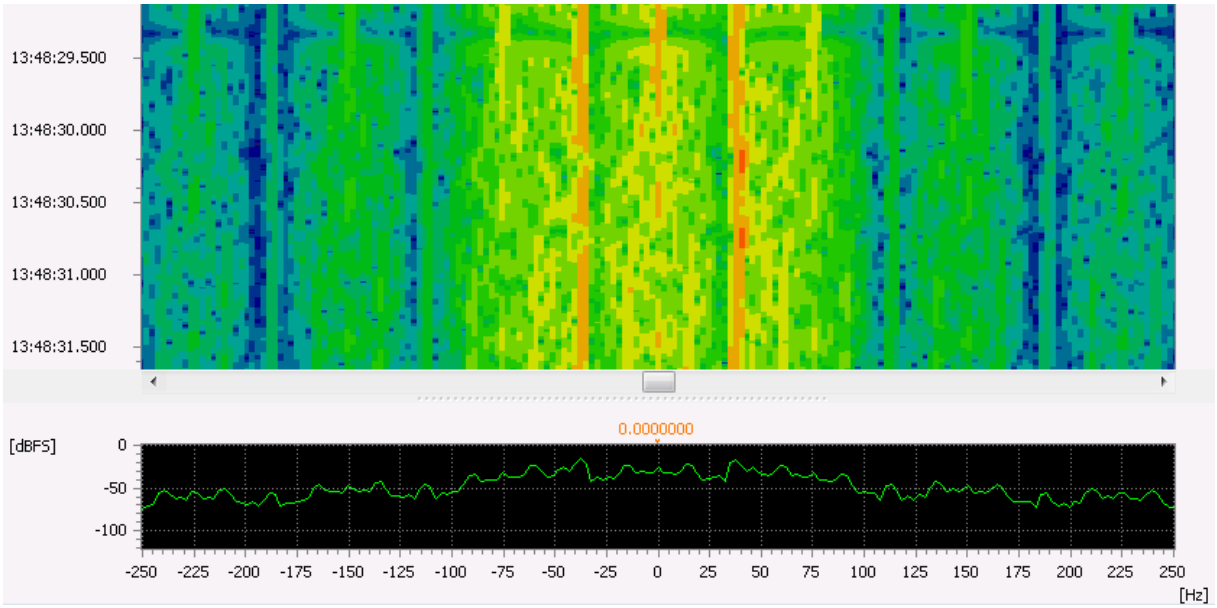


Figure 196: STANAG-5065 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Baud)	75
SR tolerance (Baud)	5
Modulation order	2
Shift (Hz)	85
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.100
Max. burst length (s)	1.000
Min. pause length (s)	0.100
VER file name	stanag_5065_fsk.ver

Table 359: STANAG-5065 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 360: STANAG-5065 Features

Appendix

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Bug reporting

Please report to: support@go2signals.ch

Required Information:

- Operating system
- Other Applications running
- Langauge of the operating system
- Screen Shot
- When did show up this problem for the first time?

Conditions of sale

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The list prices are net and exclude VAT, shipping and packing costs, unless otherwise arranged. PLATH AG reserves the right to change the prices. All special offers are subject to alteration without notice. The supplier reserves the right to accept or refuse an order.

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Dispatch

The method of dispatch may be selected by the customer. Without any shipping instructions from the customer, we reserve us the right to arrange the dispatch by any forwarder or courier of our choice. Any complaints regarding damage, delays or loss must be forwarded to PLATH AG in written form within 48h from the receipt of the goods.

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The return of defect goods requires written approval of PLATH AG before the dispatch. The charges for the shipping costs must be paid by the customer. During the warranty period, PLATH AG will bear the expenses for shipping the item(s) back to the customer. The customer is responsible for returning the goods to the supplier without them being damaged, please use appropriate packing material and insure the goods.

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- reimburse the amount of the purchase price and terminate the contract
- reimburse the reduced value of the goods according to the sales contract. Claims by the buyer expire in every case where they are not legally established within 30 days of the goods delivery. Compensatory claims against PLATH AG are not permissible unless negligence on their part can be proved by the buyer.

Glossary of Terms

AF

Audio **F**requency 40 … 20000 Hz

Audio **F**requency is the range of acoustic waves which the human can perceive, in contrast to ultrasonic waves, which humans cannot hear.

ALE

Automatic Link Establishment, commonly known as ALE, is the worldwide de facto standard for digitally initiating and sustaining HF radio communications. ALE is a feature in an HF communications radio transceiver system that enables the radio station to make contact, or initiate a link between itself and another HF radio station or network of stations. The purpose is to provide a reliable rapid method of calling and connecting during constantly changing HF ionospheric propagation, reception interference, and shared spectrum use of busy or congested HF channels.

ARQ

The **Automatic Repeat reQuest** protocol **ARQ** is a method to increase the reliability of data-transfer. The data to transfer is split into smaller packets, each packet is extended by a packet-number and a checksum. On the receiving side a checksum is generated on the received data-part of the packet and compared to the checksum that was sent. If they do not concur, the receiving station sends a message to the originator of the message, reporting which packet failed. This message prompts the originator to send the indicated packet another time.

ASCII

The **American Standard Code for Information Interchange** commonly known as **ASCII** is a character-encoding scheme originally based on the English alphabet. ASCII codes represent text in computers, communications equipment, and other devices that use text.

ASCII evolved from telegraphic codes. Its first commercial use was as a seven-bit code for teleprinting promoted by Bell data services.
ASCII includes definitions for 128 characters: 33 are non-printing control characters (many now obsolete) for formatting and 95 printable characters, both upper and lower case.

Signals consist of 1 start bit, 7 or 8 data bits, 1 or 2 stop bit and optionally a parity bit, thus each character consists of a total of 9, 10 or 11 bits.

BCH

In coding theory the **BCH codes** form a class of parameterized error-correcting codes. BCH codes were invented in 1959 by Hocquenghem, and independently in 1960 by Bose and Ray-Chaudhuri. The acronym BCH comprises the initials of these inventors' names.

Reed–Solomon codes, which are BCH codes, are used in applications such as satellite communications, compact disc players, DVDs, disk drives, and two-dimensional bar codes.

In technical terms a BCH code is a multilevel cyclic variable-length digital error-correcting code used to correct multiple random error patterns. BCH codes may also be used with multilevel phase-shift keying whenever the number of levels is a prime number or a power of a prime number. A BCH code in 11 levels has been used to represent the 10 decimal digits plus a sign digit.

Context menu

A context menu (also called contextual, shortcut, popup or pop-up menu) is a menu in a graphical user interface (GUI) that appears upon user interaction, such as a right-click mouse operation. A context menu offers a limited set of choices that are available in the current state, or context, of the operating system or application. Usually the available choices are actions related to the selected object.

dB

Decibel (Symbol: dB) is a logarithmic unit that indicates ratio or gain. Decibel is used to indicate the level of acoustic or electromagnetic waves or electronic signals. The logarithmic scale can characterize very big or very small numbers with short notation. The dB level can be viewed as relative gain or attenuation of one level vs. a second, or absolute logarithmic scale level for well known reference levels.

Decibel is a dimensionless unit.

The ratio in Bel is the base 10 logarithm of the ratio of P1 to P0:

Ratio (dB) = $10*\log_{10}(P1 / P0)$

DDC

In digital signal processing, a **D**igital **D**own-**C**onverter converts a digitized real signal centered at an intermediate frequency to a baseband complex signal centered at zero frequency. In addition to down-conversion, DDC's typically decimate signals to a lower sampling rate.

DDL

The **D**ecoder **D**escription **L**anguage is a programming language developed by Procitec for the easy implementation of modems. A compiler converts the source-code into binary intermediate code, which is interpreted by the application.

DHCP

The Dynamic Host Configuration Protocol (DHCP) is a network protocol used to configure devices that are connected to a network (known as hosts) so they can communicate on that network using the Internet Protocol (IP). It involves clients and a server operating in a client-server model.

FEC

The **F**orward **E**rror-**C**orrecting code is a method to increase the reliability of data-exchange. Additional data is appended to the original data which can be used to correct data if they are partly corrupted. This technique is applied in cases where there is no channel for back-reporting, e.g. in a broadcast situation. It is used as well in situations where the switch-over and retransmission time by far exceeds the time to generate, transfer and evaluate the correction code (deep space communication).

FFT

The **F**ast **F**ourier **T**ransformation is a variant of the Fourier transformation. This is a method to convert data between time- and frequency-domain. Data are sampled in the time-domain, in many applications they are transformed into the frequency-domain for further processing.

The DFT is the discrete variant of the Fourier transformation. It works with every integer number N of samples and requires N^2 operations. The FFT is a special variant, where N is 2^m, m being an integer. In this case only $N*\log_N$ operations are required, accelerating processing significantly for larger N.

HF

High **F**requency 3 … 30 MHz

This is the frequency range for world-wide information-transfer over radio with low bandwidth. Propagation in this range is marked by reflections of the waves in the ionosphere, a layer which encloses planet earth at a high of about 60 to 600 kilometers. This way almost every 2 points on earth can exchange information sometimes within 24 hours, either by ground wave or via reflected waves. The ionization depends heavily on the solar radiation, so the available propagation-paths are a function of the time of the day.

I/Q

I/Q data are signals represented in the complex plane by their **I**nphase and **Q**uadrature parts. While the sole amplitude information of a signal is ambiguous regarding the phase, the combination of I and Q data identifies the phase positively. The magnitude of an I/Q signal is the square-root of $(I^2 + Q^2)$, the phase is arcsin(I) plus the quadrant information derived from Q.

LF

Low **F**requency 30 … 500 kHz

This is the frequency range for medium-range information-transfer over radio with low bandwidth. Propagation in this case is restricted to ground-waves, so the coverage is limited to a few 100 kilometers.

Modem

Modem is an abbreviation for **mo**dulator / **dem**odulator. It characterizes a device which is used to transfer information over radio, telephone- or fiberglass-line. The information which is to be sent is adapted to the channel so that it can be retrieived as reliable as possible, given the characteristics of the channel.

RCM

Receiver Control Modul (receiver.exe)

SLEW

Link11 is a NATO standard exchange of for tactical data over radio. **S**ingle Tone **L**ink **E**leven **W**aveform is a variant with extended data protection by interleaving and convolutional block coding.

SNR

Signal-to-noise ratio (often abbreviated SNR or S/N) is a measure used in science and engineering that compares the level of a desired signal to the level of background noise. It is defined as the ratio of signal power to the noise power. A ratio higher than 1:1 indicates more signal than noise. Normally the values are indicated in dB.

UHF

Ultra **H**igh **F**requency 0.3 … 3 GHz

This is the frequency band for information-transfer with high bandwidth. Due to the quasi-optical wave propagation the range is limited to about 10 kilometers for omnidirectional antenna systems, and to line-of-sight links in case of directional antennas.

VHF

Very **H**igh **F**requency 30 … 300 MHz

This is the frequency range for information-transfer with medium bandwidth. Due to the more or less quasi-optical wave propagation the range is limited to some 10 kilometers for omnidirectional antenna systems, and to close to line-of-sight links in case of directional antennas.

XSLT

XSLT (Extensible Stylesheet Language Transformations) is a language for transforming XML documents into other XML documents, or other objects such as HTML for web pages etc.,

The original document is not changed; rather, a new document is created based on the content of an existing one.

List of Figures

List of Tables

Index

D

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W

X

Z